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MACHINE DESIGN

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Contents

Automatic Gearshift Tops 1940 Innovations 31
By A. H. Allen

Scanning the Field for Ideas 35

Attractive Nameplates Enhance Appearance 37
By Harold Van Doren

Utilizing the Flat Spring in Accurate Mechanisms 40
By A. M. Wahl

Ordinarily Handicaps—But Capitalized in Design! 43
By C. F. Ball

Capacity of Spring Clutches 46
By C. F. Wiebusch

Points To Consider in Applying Universal Joints 47

How Hardening and Temperature Affect Steel 49

Economies Are Effected by Welding 51

Design Features in New Machines 52

Time Has Come To Eliminate the Hangover of Conservatism! (Editorial) 54

Topics	28	New Materials and Parts	62
Professional Viewpoints	55	Calendar of Meetings	78
Assets to a Bookcase	56	Manufacturers' Publications	86
Men of Machines	57	Business Announcements	94
Noteworthy Patents	59	New Machines	98

For Itemized Table of Contents See Page 7

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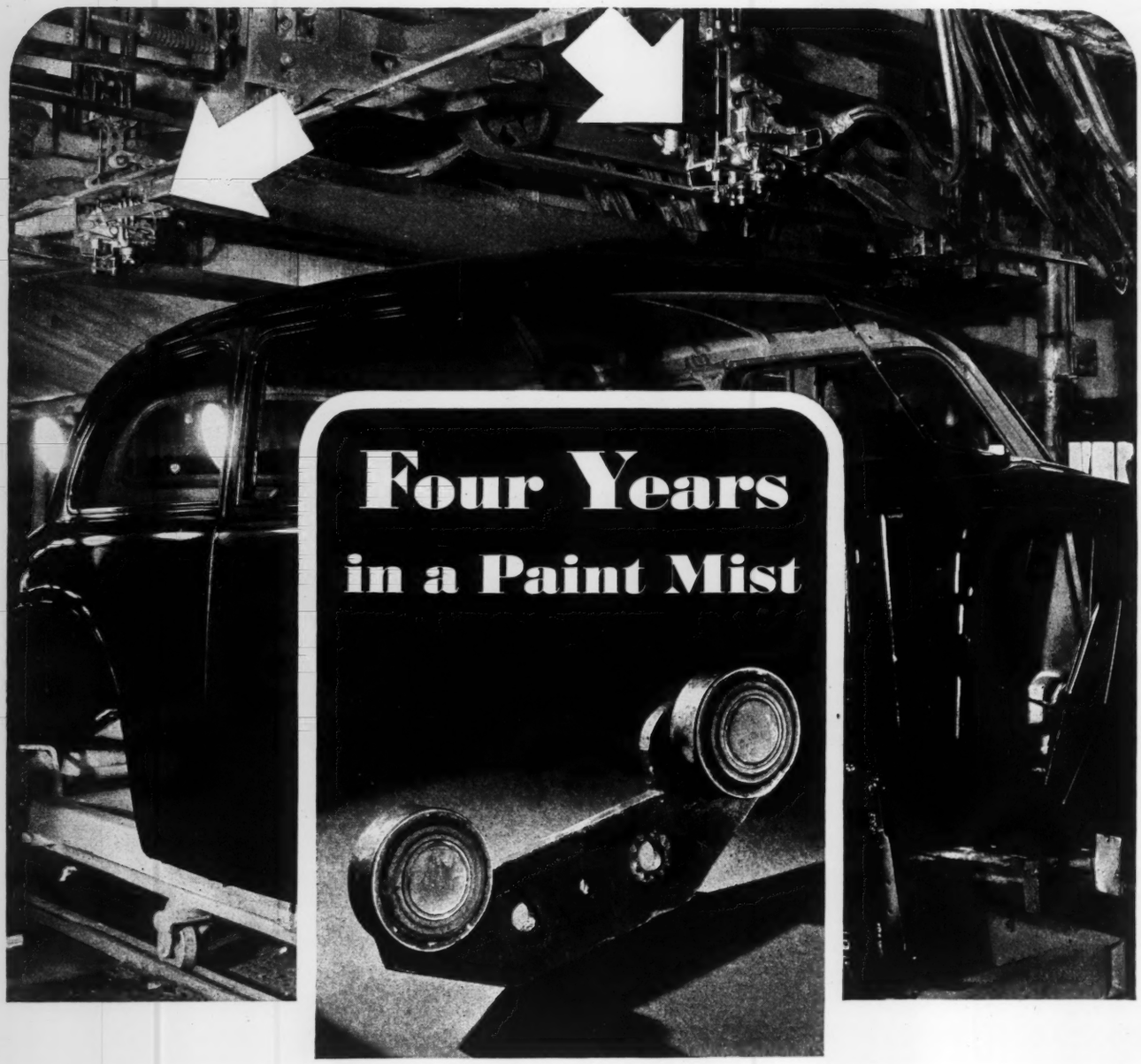


Four Years in a Paint Mist

OIL or grease is "poison" to duco, yet bearings must be lubricated.

Operating in a mist of duco spray is an abnormal condition usually considered too severe for any anti-friction bearing. But this instance serves to emphasize the effectiveness of this self-sealed, self-lubricated bearing by New Departure.

Here the bearings function as wheels on carriages which support a series of spray nozzles that traverse the width of automobile body tops as they move forward on conveyors.

Even though heavily encrusted with duco, these bearings were found to be operating successfully after four years of continuous service.

It pays to buy sealed bearings from New Departure, who originated the self-sealed, self-lubricated bearing—and whose products are *ideas* as well as bearings. 2801

NEW DEPARTURE *N-D-Seal* Bearings

New Departure • Division General Motors Sales Corporation • Bristol, Connecticut

NOTHING ROLLS LIKE A BALL

Itemized Index

CLASSIFIED FOR CONVENIENCE WHEN STUDYING SPECIFIC DESIGN PROBLEMS

KEY: EDIT., EDITORIAL PAGES; ADV., ADVERTISING PAGES; R, RIGHT-HAND COLUMN; L, LEFT-HAND COLUMN

Design Problems:

Appearance, enhancing with nameplates, Edit. 37, 38, 39, 58R

Automobiles, 1940 models, design innovations of, Edit. 31, 32, 33, 34, 80R, 82R, 84R

Clutch, spring, determining capacity of, Edit. 46

Economies, attaining with welding, Edit. 51

Joints, universal, points to consider in applying, Edit. 47, 48

Pump, using characteristics of concrete in design of, Edit. 43, 44, 45

Springs, flat, utilizing in accurate mechanisms, Edit. 40, 41, 42

Finishes:

Color, in nameplates, Edit. 38L

Wrinkle, developed for castings, Edit. 64R

Materials:

Alloys (aluminum), Edit. 55

Alloys (magnesium), Adv. 11, 81

Aluminum, Edit. 62L

Bronze, Adv. 101

Iron, Edit. 44R

Plastics, Edit. 28L

Rubber, Edit. 44R; Adv. 18

Steel, Edit. 36L, 44, 45, 49, 50, 51; Adv. 71

Mechanisms:

Cam, Edit. 45, 59L

Driving, Edit. 33, 47, 48

Hydraulic, Edit. 28, 31, 32, 33, 55L

Reciprocating, Edit. 43R, 44

Organization and Equipment:

Engineering department, Edit. 76R, 78R; Adv. 14, 64L, 65, 77, 82L, 90L, 94L

Parts:

Bearings, Edit. 59L, 62L, 66R; Adv. 6, 9, 20, 63, 76L, 79, 99

Belting, Adv. 25

Cast parts, Adv. 71

Chains, Edit. 62R; Adv. 15, 69, 73

Clutches, Edit. 46; Adv. 74

Controls (electrical), Edit. 35R, 36R, 64R, 68R, 70R, 72R, 74R, 76R, 80R, 82R; Adv. 12, 13, 16, 23, 27, 61, 104

Counters, Edit. 35, 70R; Adv. 8

Couplings (flexible), Edit. 66R; Adv. 91R, 97

Electric equipment, Adv. 21

Engines, Edit. 59L; Adv. 95L

Fastenings, Adv. 17, 72L, 89, 96L

Filters, Adv. 67

Forgings, Adv. 75

Gears, Edit. 32, 33, 44R, 82R; Adv. 80L, 85, 92L, 95R

Hydraulic equipment, Adv. 19, 26, 94L

Instruments, Edit. 39L

Joints, Edit. 47, 48; Adv. 83L

Lubrication and lubricating equipment, Adv. 70L

Motors, Edit. 35R, 36L, 62L, 68R, 72R; Adv. 2, 22, 24, 29, 30, 83, 86L, 103

Oil seals and packing, Adv. 4, 18, 68L

Plastic moldings, Adv. 90L

Pneumatic equipment, Adv. 66L

Pumps, Edit. 43R, 44, 45; Adv. 86L, 88L, 91L, 93L, 97R

Speed reducers, Adv. 88L, 91L, 98

Springs, Edit. 34, 40, 41, 42, 45, 46, 60, 80R; Adv. 92L, 95L

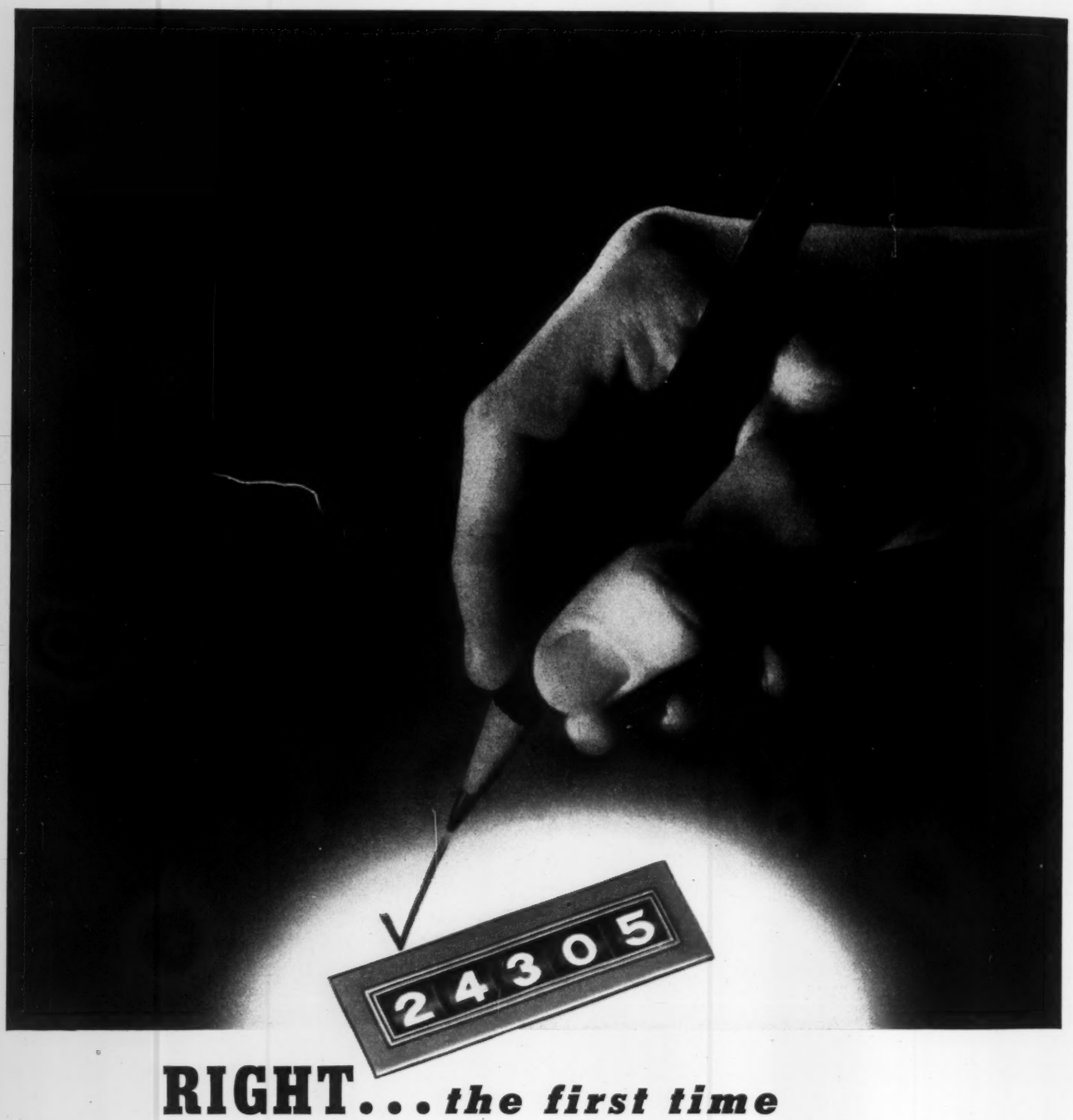
Tubing, Edit. 47, 48

Valves, Edit. 32, 43R, 44, 45, 59R, 66R

Variable speed transmissions, Adv. 3, 99R

Welded parts and equipment, Edit. 44, 51; Adv. 102

Wire, Adv. 10



RIGHT... *the first time*

Production figures—what is the best way to get them *quickly* and *accurately?* With Veeder-Root Counting Devices.

On many types of machines serving industry and business you find these counting devices—some that count and record operations and pieces; some that measure volumes and lengths; counters that give accurate figures, not estimates, and facts, not fiction; devices that give on-the-second news of production—clearly and truthfully reported — as it happens.

Veeder-Root Devices are used not only to supply accurate production figures, but to back up performance claims, and in many cases, to increase the salability of a machine by increasing its usefulness. Veeder-Root Engineers are constantly finding unusual applications that usually lead to profits. A wealth of experience is at your disposal. See what can be done for you. Send for our free booklet.

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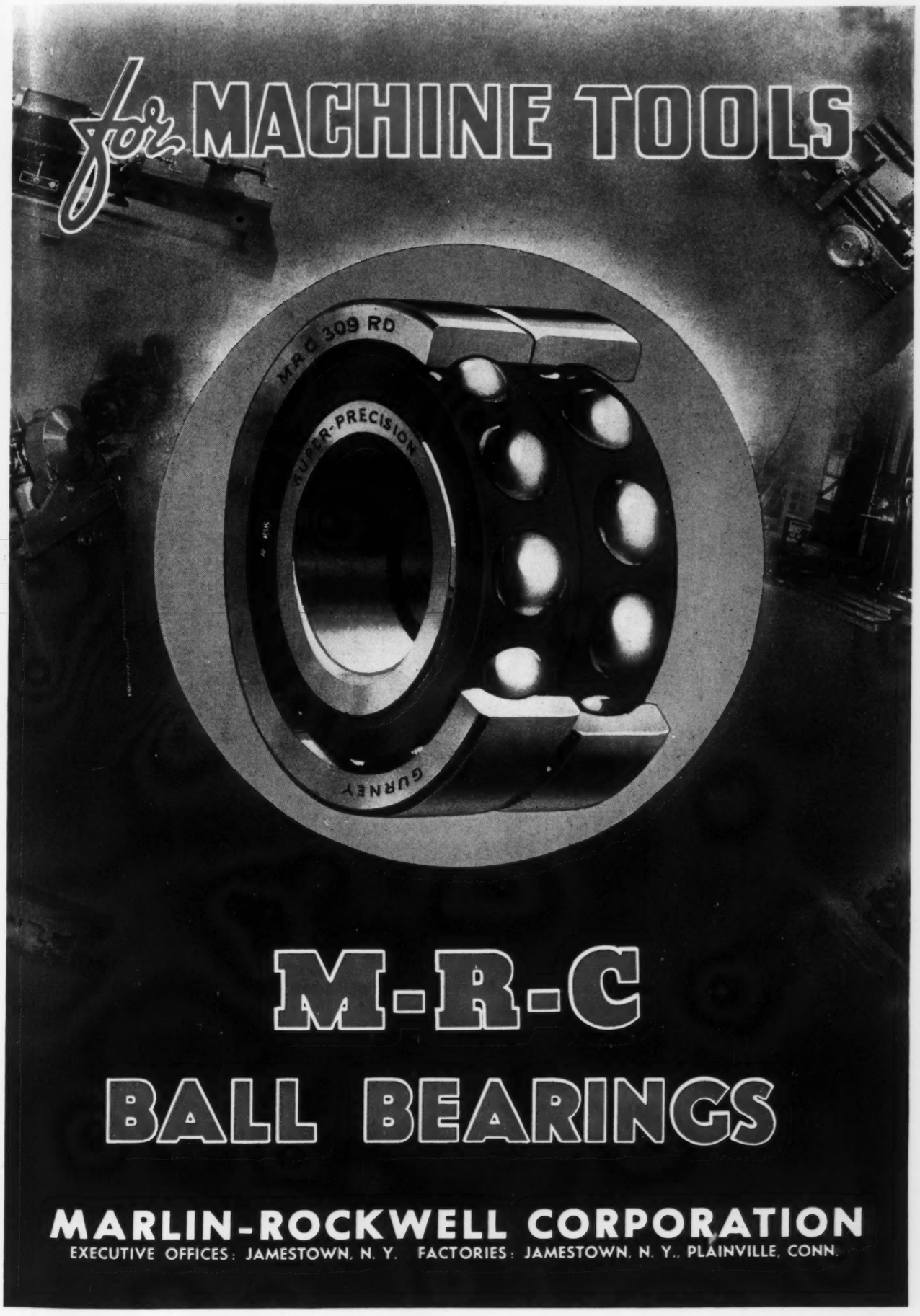
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MARLIN-ROCKWELL CORPORATION
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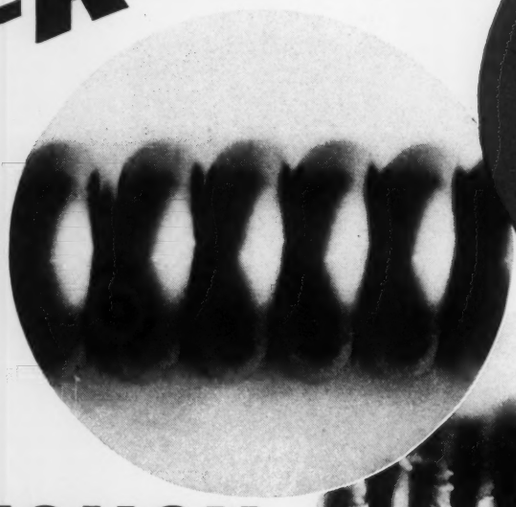
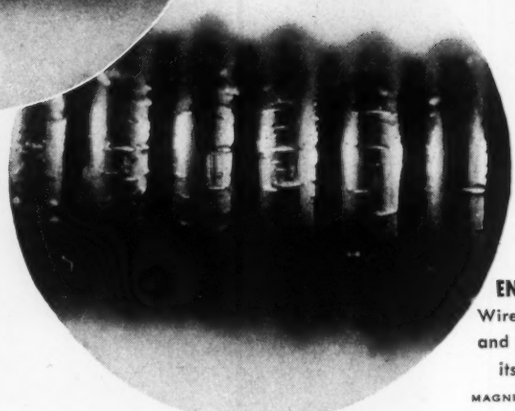
See the S-T-R-E-T-C-H of FORMEX Reg. U. S. Pat. Off. MAGNET WIRE



FORMEX WIRE
Wire stretched 20% and wound on its own diameter
MAGNIFIED ABOUT 15 TIMES



ENAMELED WIRE
Wire stretched 10% and wound on twice its own diameter
MAGNIFIED ABOUT 15 TIMES

TOUGH and FLEXIBLE FILM Cuts Down Rejects

STRETCH or extensibility is one measure of film toughness. It is the property that determines how much winding tension a film will stand without developing cracks. It also indicates ability to stand sharp bends.

With respect to stretch, Formex wire rates high. It is at least three times tougher and more flexible than conventional oil-type enameled wire. See pictures above. It is also much more abrasion resisting. These are the reasons why it is so well suited for modern high-speed winding machines. Definitely, it cuts down on rejects and lowers winding costs. That means savings.

Also—as compared with fabric-covered enameled wire—it takes up less space and saves copper. In most sizes, it costs less per foot. It resists many solvents; it has high dielectric strength and long life.

These, and still other properties, make Formex wire worthy of study by every manufacturer who is interested in lowering costs or improving his product. For more details, see Bulletin GEA-2973. Prices, of course, will gladly be furnished. Address nearest G-E sales office or General Electric, Dept. 6—201, Schenectady, New York. 520-179

FORMEX WIRE IS A PRODUCT OF GENERAL ELECTRIC RESEARCH

GENERAL ELECTRIC

GENERAL ELECTRIC MAGNET WIRE
ALWAYS THE RIGHT TYPE FOR EACH JOB

AND JUST WHAT IS DOWMETAL ?

DOWMETAL* is the trade name for a group of magnesium alloys all containing 90-98% magnesium. Within this range, specific compositions have been developed to meet the varying needs of industry.

Magnesium is an elemental metal and, just as iron, copper, tin, zinc, and aluminum have their basic uses and functions in the metal working fields, so has magnesium. Where *extreme* lightness (magnesium is ⅓ lighter than any other metal commonly used) plus great strength and durability are required, magnesium alloys meet the specifications as no other metal can. They can be fabricated by all common methods—rolling, forging, welding, extruding, die casting, sand casting, and stamping; and are the easiest of all metals to machine.

DOWMETAL'S use in both single unit and mass production operations allows manufacturers to produce products that are easier to handle, cut power, time and labor requirements or reduce dead, useless weight. These advantages are reflected in the enthusiastic acceptance of magnesium alloys.

Write today for the booklet, "Industry's Lightest Structural Metal." It is a complete and concise discussion of magnesium alloys—their properties, specifications and fabrication. It illustrates graphically the wide range of applications in which industry is taking advantage of DOWMETAL'S extreme lightness.

THE DOW CHEMICAL COMPANY
1760 EAST MAIN STREET MIDLAND, MICHIGAN

Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Streets, St. Louis; Field Building, Chicago; 9 Main Street, San Francisco; 4151 Bandini Blvd., Los Angeles.

Visit exhibits of The Dow Chemical Company and its Great Western Division, at the Golden Gate International Exposition.

*Trade Mark Reg. U.S. Pat. Off.

DOWMETAL

MAGNESIUM ALLOYS

INDUSTRY'S LIGHTEST DOWMETAL STRUCTURAL METAL

REVOLUTIONARY MERCURY SWITCH DEVELOPMENT

At left, actual size of the largest Durakool Mercury Switch developed to date—without insulating cover. Rated at 200 amperes. Other Durakool Switches from 1 ampere up.

Check these features of the New Double Reduction Durakool

- 3-year guarantee
- *Cannot* pit, burn or corrode
- Simplifies control operation
- Saves money
- Gives complete safety
- Small, compact
- Permanent calibration
- Short-radius action
- Versatile

DURAKOOL

TRADEMARK REG. U. S. PAT. OFF.

MERCURY SWITCHES

The PERFECTED Electrical Contactors

"Double reduction" for heavy duty. Removes last obstacle to application of hermetically sealed contacts to higher current ranges. Permits unheard of 3-year performance guarantee. Of outstanding interest to every machine designer and electrical engineer.

MANY machine designers and electrical engineers know the pioneering mercury switch developments by Durakool engineers. The Durakool metal-cased liquid "fill" mercury switch removed many of the limitations on this type of device. For the first time, heavier capacities were possible, and the useful range of the mercury switch extended immeasurably.

Now, Durakool announces still another important advance, the introduction of a gas fill, under high pressure, to the standard liquid fill Durakool Mercury Switch. This development results in a two-fold reaction. It deoxidizes the hermetically sealed metal case, and forms an arc-blanketing agent which eventually ends arcing. It is believed the longer Durakool operates the more efficient it becomes. Its performance is guaranteed for 3 years.

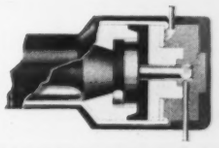
Today, Durakool is operating on devices requiring 2400 breaks per minute, 25,000 breaks a day, on induction motors up to 75 h.p., on 200 amp. circuits at 220 volts, and 140 amp. at 550 volts. In standard tests, Durakool Switches have withstood service at 2300 to 5500 volts.

The prime importance of these advances is the broad avenue of savings, economy and freedom from trouble opened up, the emergence of a new "tool" for product betterment, and simpler means of achieving difficult objectives.

BIG Users

Leading manufacturers have already discovered the amazing advantages of this revolutionary mechanism. Big users say that Durakool withstands service no other switch can handle, is impervious to mechanical shock. They say *they never have had to replace a Durakool!* It is safe, foolproof, compact; inexpensive and simple to apply; it saves money, simplifies design and eliminates parts. It has unfailingly accurate, unvarying time characteristics, operates even on 2 degree angles . . . and is moisture-proof, corrosion- and explosion-proof.

The product, the principle, is there. It is just a case of applying it to suit your needs. And Durakool is so simple, "clean," dependable, versatile and flexible, that application is very simple. Durakool engineers will work with you to the very limit. Inquiries are invited. Descriptive literature will be sent without obligation. DURAKOOL, Inc., 1003 North Main Street, Elkhart, Indiana.



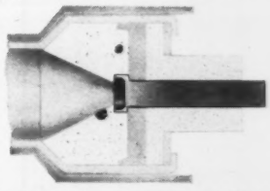
Slight Changes Cover Special Needs—Change of liquid fill quantity adapts Durakool to various needs. Where few contacts per day are required, or switch is subject to excessive mechanical vibration, a larger quantity is used. When several contacts per hour are necessary, a different type and quantity of fill are used.

Extra Fast or Slow Operation—On rapid operation, added heat is generated. Here a larger ceramic cup holding a larger retained body of mercury is used, increasing the surface area of contact. Larger body of mercury aids heat dissipation.

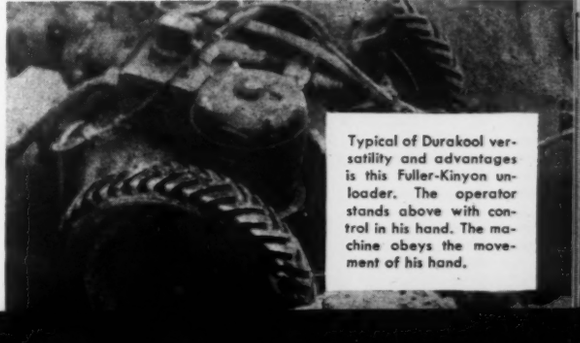
On slow motion, a smaller ceramic cup and retained body of mercury is used. Circuit is thus controlled by a narrower operating angle.

Wide or Narrow Operating Angles—Where weight, overhang, fast motions, or wide angles are important, Durakool uses shorter body of metal and moving mercury. Compact construction is less sensitive to vibration and bumps.

Durakool Switches with longer bodies of metal and moving mercury operate on smaller angles. With shallow ceramic cup and small body of retained mercury, they function at minimum angle.



Increased Voltages—By using a ceramic, a larger metal envelope and an electrode of smaller capacity and increasing distance between flexible lead connections, Durakool can operate on higher voltages at capacities equivalent to the electrode size. Durakools of this type have successfully been tested on 2300 and 5500 volts.



Typical of Durakool versatility and advantages is this Fuller-Kinyon unloader. The operator stands above with control in his hand. The machine obeys the movement of his hand.

5500 KNOWN APPLICATIONS

With the revolutionary advances which Durakool has introduced to the art of mercury switching, Durakool switches, tubes and relays are being applied to a greater range of applications than ever dreamed possible. 5500 known uses have already been discovered. A few of the more outstanding uses are listed below.

Air conditioning machine controls
Bookkeeping machines
Coal stokers
Concrete mixers
Diesel engine cut-outs
Elevator inter-locks
Fence chargers
Float switches
Forming presses
Furnaces
Motor vehicle safety switches
Phonographs
Pressure controls
Precision devices
Printing presses
Pumps
Steam boiler safety controls
Toilets—marine
Water systems

Finger Tip Control OF LIGHT INTENSITY!

JUST TURN THE DIAL . . . . FOR MORE LIGHT OR LESS . . . . . TO SUIT THE MANY VARIETIES OF TRACINGS . . . . . WITHOUT CHANGING OPERATING SPEED . . . . . OR AMOUNT OF HEAT IN DRYER!

This revolutionary improvement is possible only with Pease Model "22"—because of its patented 3-speed lamps—10, 15, or 20 amperes each, as you wish.

Constant operating speed assures better prints and the intensity of all lamps is changed at the same time. Rejected prints . . . common with machines the running speed of which must be changed . . . are virtually eliminated.

Other features of the PEASE "22" include:

1 **SPEED UP TO 24 FEET A MINUTE** (on 220 DC) for large tracings, permitting slower paper for normal size tracings and thus better prints,

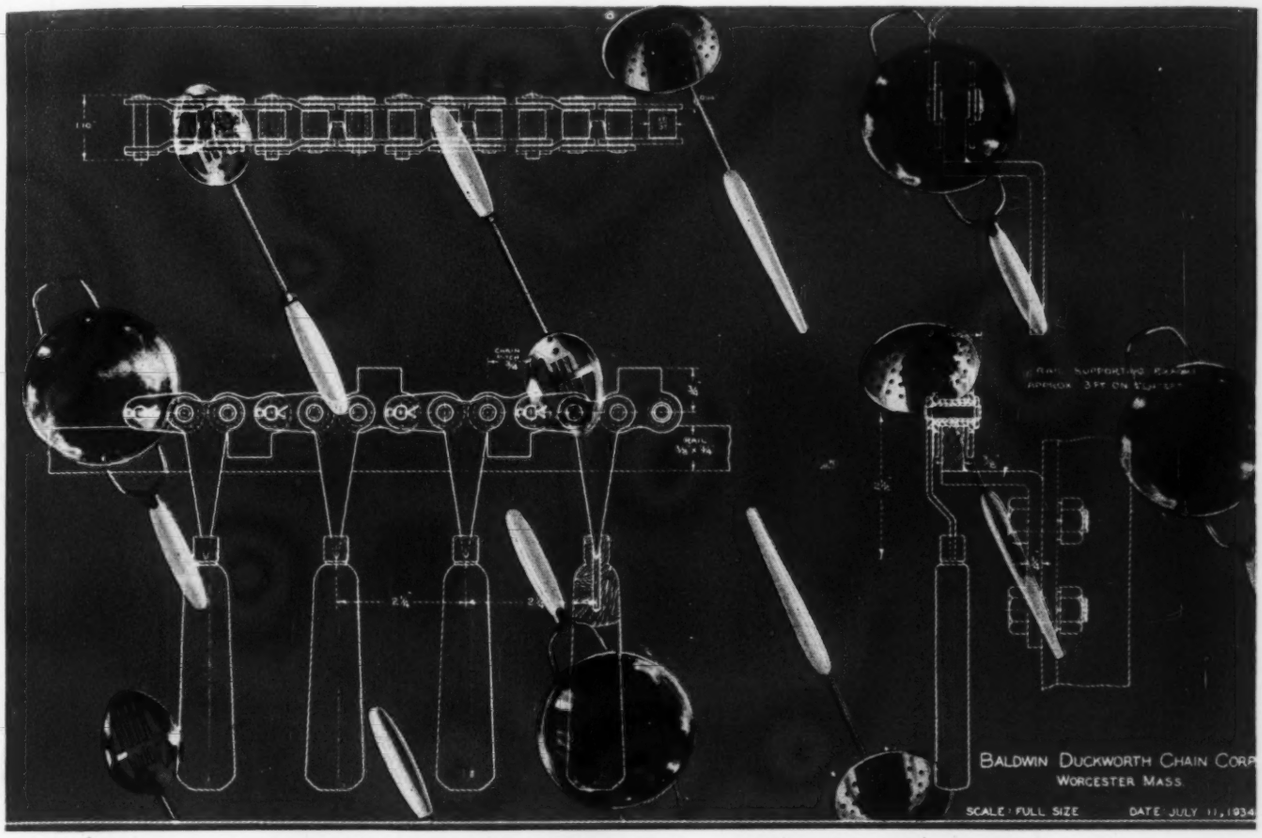
2 **HORIZONTAL WATER WASH** which practically eliminates bleeding, blocking and distortion of paper,

3 **QUICK CHANGE POTASH-HYPO APPLICATOR** providing almost instantaneous change from blue to negative prints and consuming much less chemical,

4 **9 DRYING DRUMS** which mean speedy drying, but at low temperature, prints as flat as hung wall paper and elimination of scorching and slaty brittleness.

These are just a few reasons why the Pease "22" leads the blueprint machine parade . . . more prints, sharper prints, flatter prints and lower costs. Ask today for complete information about the "22".

THE C. F. PEASE COMPANY
2606 West Irving Park Road • • • Chicago, Illinois

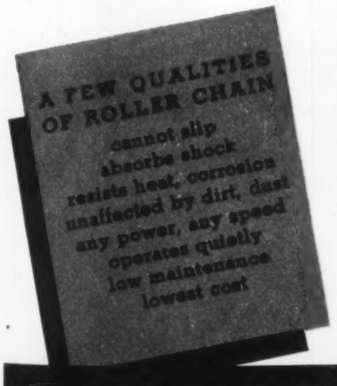


BALDWIN CHAIN

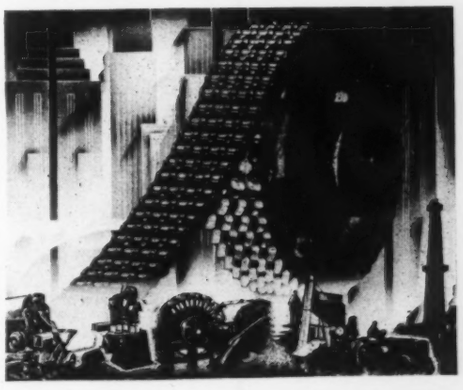
Cuts Costs in the Finishing Department

This blue print shows how Baldwin engineers eliminated an expensive operation for a utensil manufacturer who previously hand-dipped his handles. Now he saves money, gets more production—and because Baldwin roller chain is positive in action he turns out more uniform and more attractive handles for his many products.

Perhaps you need accurate timing of some complicated machine instead of a relatively simple conveyor, like the one shown here. All the more reason to avail yourself of the many years of experience stored up in the Baldwin Engineering Department. And, in signing off, let us hint that the advantages of roller chain in positive control and long effective life are not costly; in fact, they often are the most inexpensive, even in first cost.



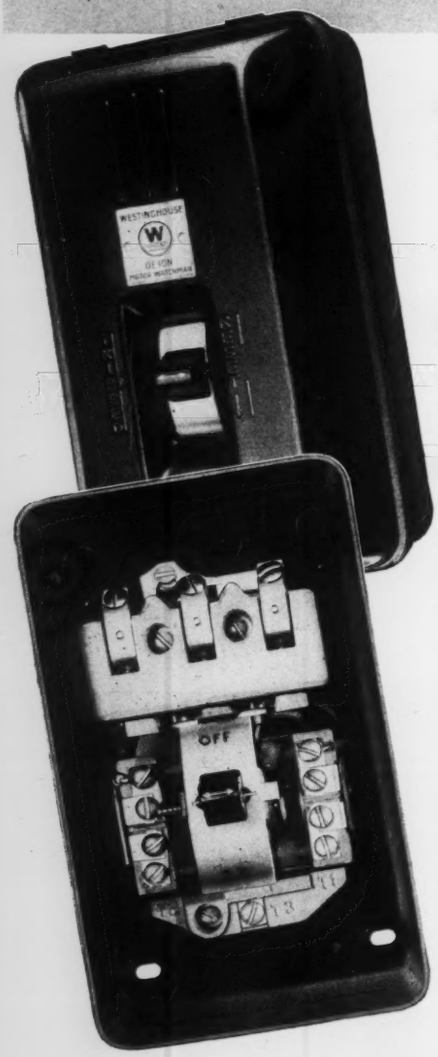
BALDWIN-DUCKWORTH
Division of Chain Belt Company
Springfield, Mass.
Factories at Springfield and Worcester, Mass.



YOU are Building the World of Tomorrow

Important to you, therefore, is the consolidation of the Chain Belt Company of Milwaukee and the Baldwin-Duckworth Chain Corporation of Springfield and Worcester, Mass. Whether you are equipping a plant or processing materials this merger can help you to do it better, more profitably.

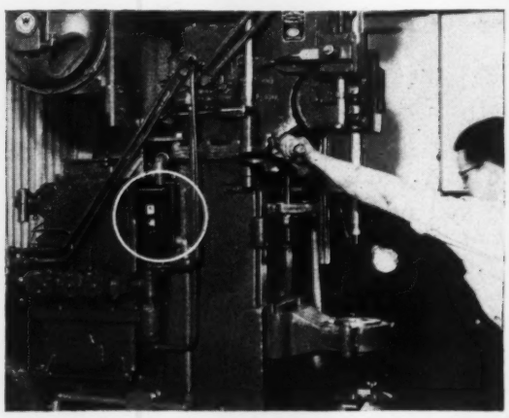
new LOW COST MANUAL STARTER FOR MOTORS UP TO 7½ HP



- Exclusive Westinghouse "De-ion" principle of arc quenching protects contacts from burning or beading when circuit is broken.
- Indicating handle shows clearly whether starter is on, off, or tripped.
- Safety interlock prevents accidental contact with live parts.
- Snap action bi-metal disc relay protects motor from overload.
- Ample wiring space, easy to mount on machine, panel or wall.
- Standard, dust and water-tight, and explosion-proof enclosures.

J-20848

A phone call to your nearest Westinghouse office, electrical wholesaler or industrial agent will bring complete installation data and prices.



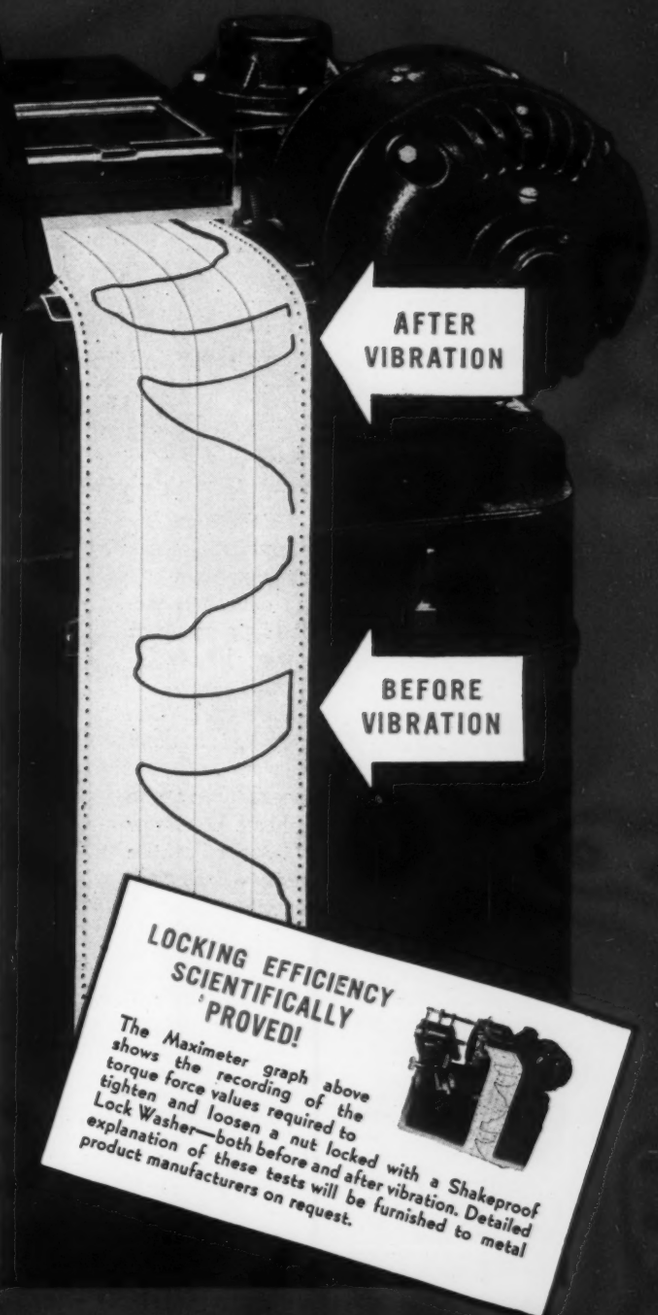
WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa.

Westinghouse "De-ion" Motor Watchman

W WESTINGHOUSE ELECTRIC

CONSIDER THIS RECORDED EVIDENCE

of SHAKEPROOF Locking Power



ACTUALLY LOCKS TIGHTER UNDER VIBRATION!

External Type

Internal Type

Countersunk Type

External-Internal Type

Hundreds of scientifically conducted tests on precision-built testing machines give factual evidence of the outstanding locking efficiency of Shakeproof Lock Washers. Of particular interest is the data secured from tests on the Maximeter, an electrically operated machine which graphically records the torque force values required to tighten and loosen nuts and screws. These tests conclusively prove that while Shakeproof Lock Washers hold tightly on initial contact, they actually lock tighter after exposure to vibration — your assurance that vital connections locked with Shakeproof will stay tight.

SHAKEPROOF LOCK WASHER CO.

Distributor of Shakeproof Products
Manufactured by Illinois Tool Works

2551 North Keeler Avenue • Chicago, Illinois

Plants at Chicago and Elgin, Illinois In Canada: Canada Illinois Tools Ltd., Toronto, Ont.

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FREE!

A small kit containing samples of Shakeproof Products will be sent upon request.

LOCKING EFFICIENCY SCIENTIFICALLY PROVED!

The Maximeter graph above shows the recording of the torque force values required to tighten and loosen a nut locked with a Shakeproof Lock Washer—both before and after vibration. Detailed explanation of these tests will be furnished to metal product manufacturers on request.

"Fastening

SHAKEPROOF

Headquarters"

SEMS Fastening Units . . . . Lock Washers
Locking and Plain Terminals

Thread-Cutting Screws . . . . Locking Screws
Spring Washers . . . . Special Stampings

The Story *of the* Puzzling Pump

AND HOW DU PONT NEOPRENE HELPED TIMKEN MAKE IT FOOLPROOF

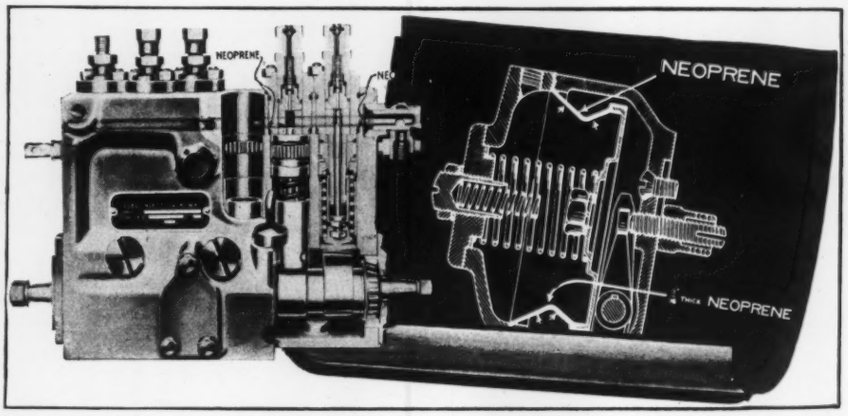
A FEW YEARS AGO, the Executive Engineer of a leading machine parts manufacturing concern was making an inspection trip through a branch factory when he was hailed by a group of men in a corner of the power house.

"Come take a look at this sick diesel fuel injection pump," they said. "Can we fix it, or shall we just take it out and give it a decent burial?"

The Executive Engineer looked at the pump and scratched his head. You know what he was up against . . . for in those days a fuel injection pump was as complicated as a Chinese puzzle.

"Boys," he said finally, "you've got me. Better wire the people who made it. And I'm going to see what I can do about getting a simplified yet efficient pump."

He did. Others did too. And that's what led the Timken Roller Bearing Company to design a fuel injection pump so simple and reliable that almost any mechanic could understand it. In this new pump the number of separate parts was minimized. Whole sections were made easily replaceable.



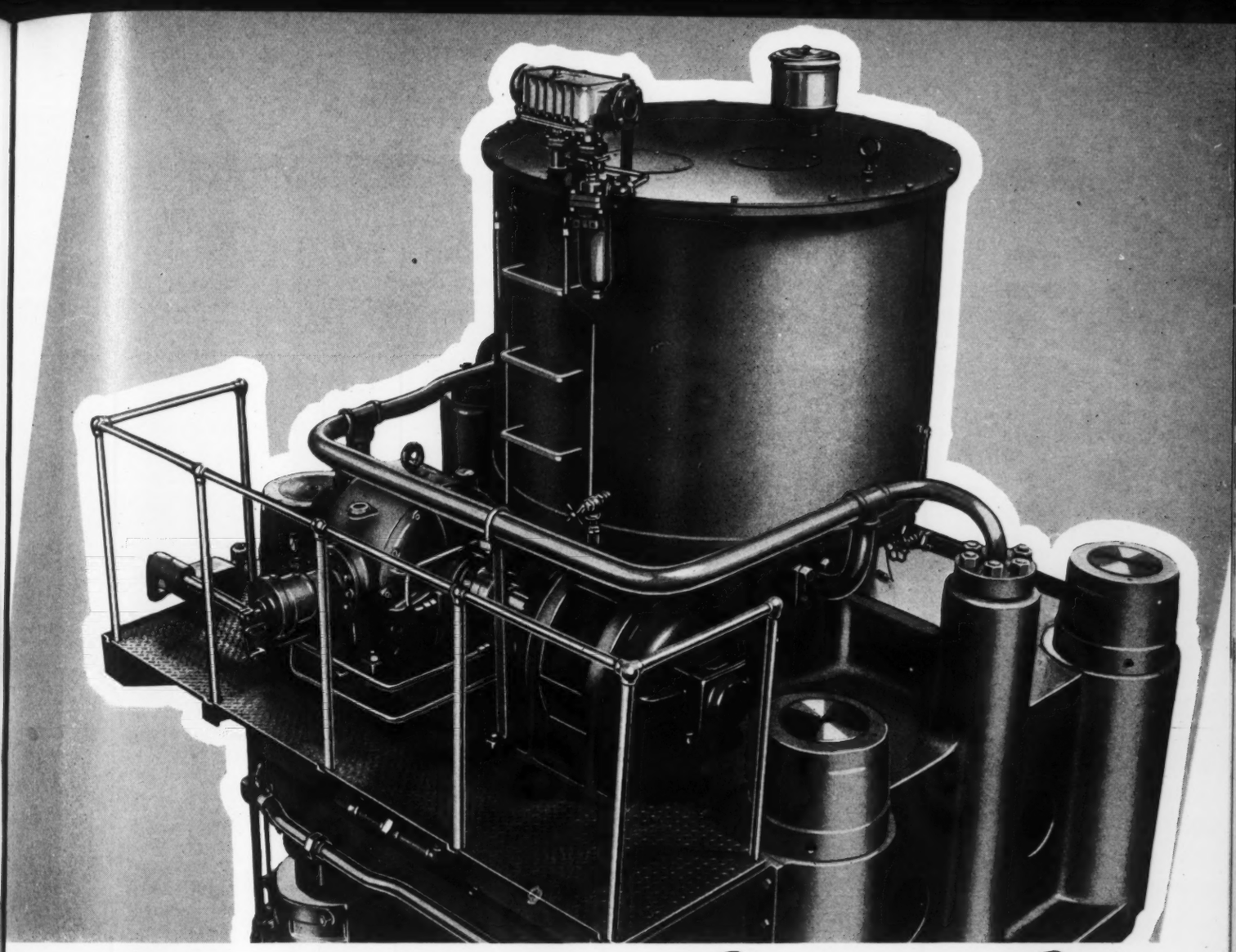
One of the factors which made this improved pump possible is the unique performance of neoprene, Du Pont's chloroprene rubber, in the presence of oil and heat. Neoprene sealing units are used extensively . . . in the mechanical governor, in the center shoulder of the pumping unit, on the control shaft, and in many other places. In the vacuum-type governor, too, neoprene is an important part of the bellows and diaphragm assembly.

So, thanks in part to neoprene, fuel injection pumps are available that aren't necessarily puzzling... one of the thousands of cases where neoprene has helped solve design problems. We hope that this story will suggest ways in which neoprene can be useful to you too. Keep abreast of new uses of neoprene by writing for your subscription to the free, monthly, newsy "Neoprene Notebook."

DU PONT

NEOPRENE

E. I. du Pont de Nemours & Co., Inc.
Rubber Chemicals Division
Wilmington, Delaware



THE DETERMINING FACTORS OF *Practical Press Performance* CENTER AROUND ITS OPERATING SYSTEM

The operating system must measure up to its responsibility — if the press is to be successful.

For double assurance – consider the many advantages of THE HYDRO-POWER OPERATING SYSTEM. Besides adding the maximum degree of VERSATILITY to the press – the HYDRO-POWER Closed Circuit steps up its production capacity to modern requirements – with every press movement under perfect control.

Basic to the success of THE HYDRO-POWER SYSTEM of Press Operation is the HYDRO-POWER RADIAL PUMP which far surpasses any previous developments – in design principle – security against costly production delays – influence on versatile press performance – and the long life service it renders.

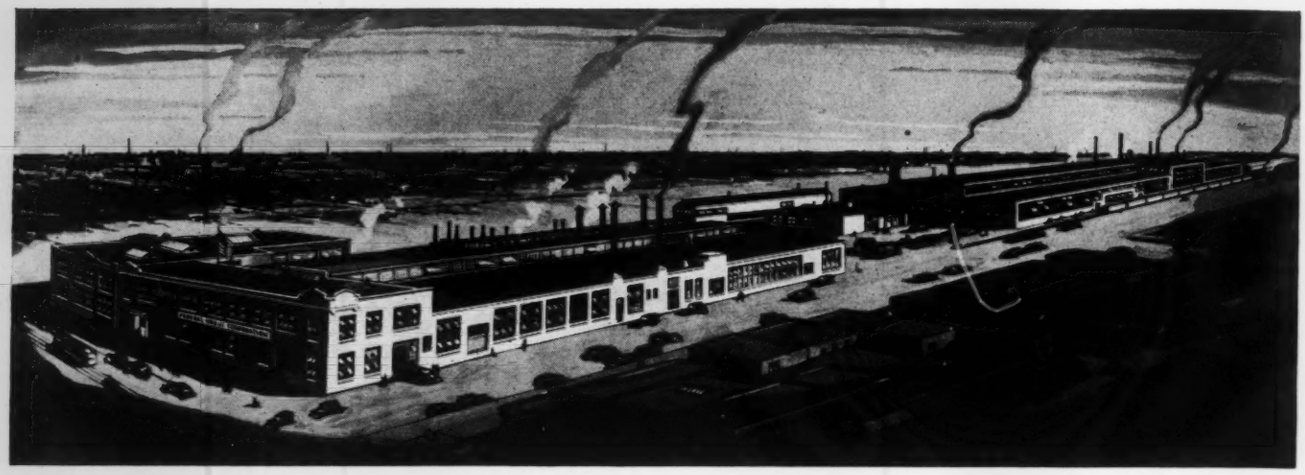
Plan to build future presses around THE HYDRO-POWER CLOSED CIRCUIT SYSTEM built especially for press service. No matter what the press operating requirements might be – THE HYDRO-POWER SYSTEM is readily adapted to the situation. Hundreds of diversified applications to presses testify to this. Our experience and modern engineering facilities are at your service.

Write for Bulletin 391 describing THE HYDRO-POWER SYSTEM in detail.

HYDRO-POWER SYSTEMS, INC., Grant Bldg., PITTSBURGH, PA., U. S. A.

HYDRO-POWER SYSTEMS

MODERN DRIVES FOR MODERN MACHINERY

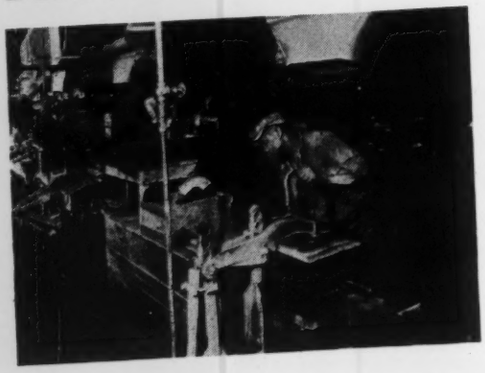


A Complete Bearing and Bushing Service

RESEARCH . . .

DESIGN . . .

PRODUCTION . . .



FOR MACHINE and APPLIANCE MANUFACTURERS and ENGINEERS

YOU can bring your bearing and bushing requirements here, in design or blueprint stage, and be assured of capable handling, right to delivery of the finished product.

A broad background of 40 years' experience in *all* applications of sleeve-type bearings and bushings, unexcelled laboratory and engineering facilities, and one of the largest plants devoted exclusively to bearing and bushing manufacture, make Federal-Mogul well equipped to handle your requirements, large or small.

Federal-Mogul develops alloys, designs and produces millions of sleeve-type bearings for countless applications in Industrial, Automotive, Agricultural, Aircraft, Electrical and Household machines and appliances. The unusual experience thus gained is turned to your benefit in development, design and production. Consultation does not obligate you. Specifications or blueprints will help. Write us at Detroit.

A "little library" of useful, authoritative reprints on Bearing Developments and Improvements is yours, free of cost, when requested on your company letterhead. Write for it now.

FEDERAL-MOGUL CORPORATION

Pacific Division: 210 Van Ness Ave. S., San Francisco, Calif.

811 SHOEMAKER AVENUE • DETROIT, MICHIGAN

I THOUGHT THEY WERE PASSING THE BUCK!"

1 **Was I burned up** when the air pressure failed again! "You couldn't pay me to keep a machine like that new compressor!" I yelled.

2 **I called** the Tornado Compressor Company*: "Your new compressor wouldn't pump up a bicycle tire," says I. "It sounds funny and won't come up to pressure. What can you do about it?"

3 **"So they claim** something is wrong with the motor!" I fumed. "Sounds to me like passing the buck. What I want is air pressure — not excuses!"

4 **In a few hours,** though, in walks a G-E engineer. "The Tornado Company tells us you're having trouble with a G-E motor," he says. "Let's have a look at it."

5 **I hadn't realized** how low the voltage was until he showed me his tests. We were trying to run the compressor on an already overloaded lighting circuit. Nothing was really wrong with the compressor unit.

6 **It runs like a song** with new wiring. Now I'm glad to tell anyone: "You can't beat a Tornado Compressor, especially when it's equipped with a G-E motor."

THIS true account is typical of the way G-E service builds good will for machinery manufacturers whose machines are G-E equipped.

No matter where your customers are located, they can always get quick service from our sales engineers in 103 cities, our 28 warehouses, and our 25 service shops. Charges for such service calls are extremely reasonable.

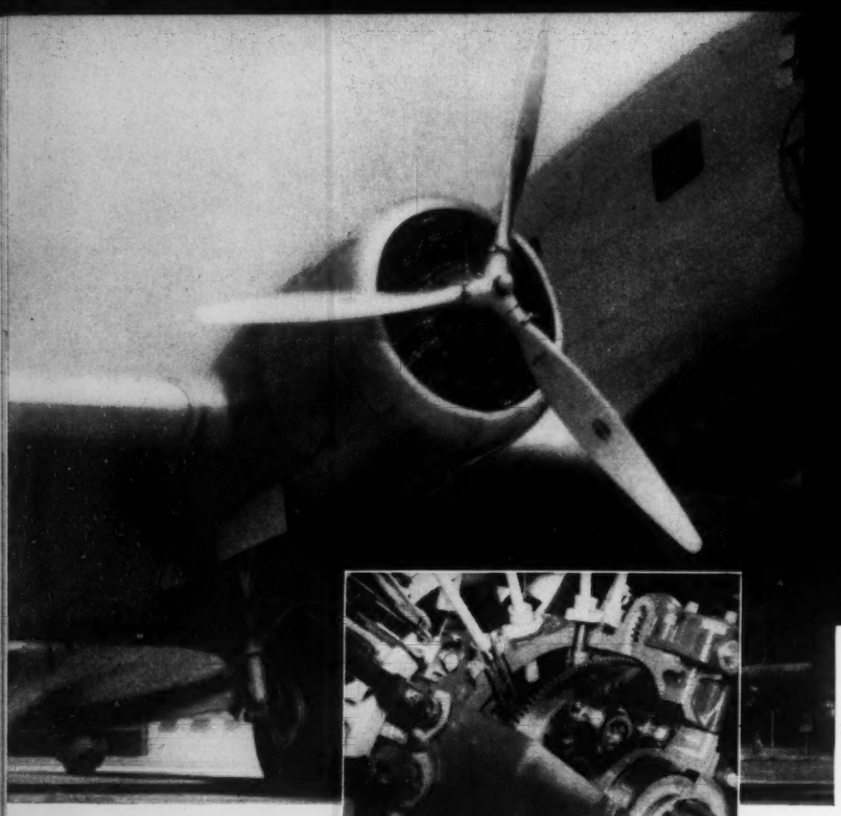
Are you *now* in need of any information on electric equipment? Perhaps a discussion of your requirements with our engineers might help you iron out an electrical design problem. Just call our nearest office or write to General Electric, Schenectady, New York.

*TORNADO *is not the manufacturer's real name, of course.*

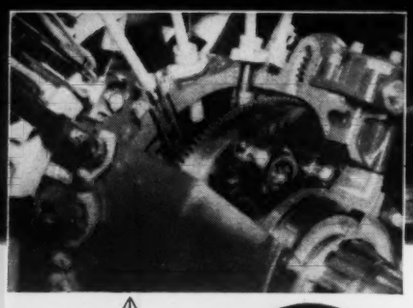
NEW YORK WORLD'S FAIR—SEE THE G-E "HOUSE OF MAGIC"—SAN FRANCISCO EXPOSITION

GENERAL ELECTRIC

011-539



WRIGHT CYCLONES
Use Planetary-gear System for Dependability and Compactness



Planetary-gear system used in Wright Cyclone aircraft engines

Planetary-gear system used in General Electric gear-motors

Typical G-E gear-motor

You Get the Same Advantages in G-E Gear-Motors

LIGHT WEIGHT, compactness, simplicity are extremely important in all phases of aircraft engine design. The Wright Aeronautical Corporation has solved the problem of obtaining the desirable light weight, compactness and efficiency in the reduction gearing of Cyclone propeller shafts by using a planetary gear system.

By using G-E gear-motors for low-speed drives, industry, too, can obtain the very desirable feature of compactness, with that high degree of reliability so essential in modern airplane drive, since G-E gear-motors use the same type of planetary system in their gear-reduction units as is used in the propeller drives of modern airplane engines.

No matter what type of low-speed drive you may need for your conveyors, pumps, mixers, or other low-speed machines, a G-E gear-motor is the correct solution. General Electric gear-motors are available in ratings from $\frac{1}{8}$ to 75 hp, with output speeds from 6 to 600 rpm, in polyphase, single-phase, or direct-current types—a type of modification to fill every low-speed drive purpose.

Investigate the many advantages obtainable by the use of G-E gear-motors for your low-speed drives. For further information, call the nearest G-E office or write General Electric, Schenectady, New York.

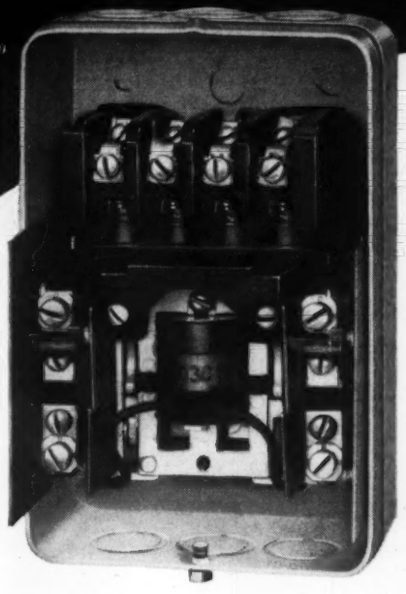
GENERAL ELECTRIC

020-389

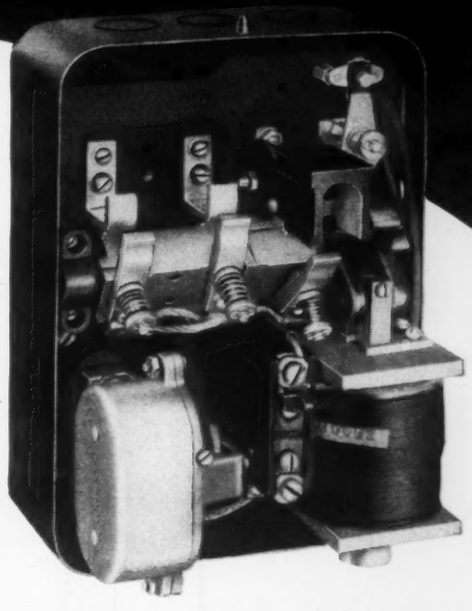
Here's What's New

in MAGNETIC STARTERS

FOR A-C MOTORS:
CR7006-D50



FOR D-C MOTORS:
CR4052



New isothermic overload relay used on both starters adjustable for either manual or automatic reset.

Push-button or selector switch can be obtained in cover of new a-c starter, making it a complete, self-contained control.

SMALLER than any other starter we've ever offered, this new Size O is ideally suited for controlling motors rated up to two horsepower. Its compactness saves space on built-in control systems. Actually, it is little larger than a manual starter, yet it provides the advantages of remote, push-button operation, isothermic overload protection, and undervoltage protection—just as do starters three times its size. Fine-silver to fine-silver contacts, and a new type of operating magnet with built-in pole shaders and air gap assure a designer that the machine he equips with the new Size O starter will stand up electrically. Price of the new starter, for 3-phase motors, is $14.00.

A NEW design from line connections to load terminals, this starter provides three-point sequence starting for d-c motors. A mechanical time-delay mechanism, in constant engagement with the operating shaft, prevents chance of false operation during starting. For the first time in a d-c starter, isothermic overload protection is provided.

General Electric, Dept. 6A-201,
Schenectady, N. Y.

Please send me your latest information on:

☐ *New Size O a-c starter*
☐ *New CR4052 d-c starter*

Name .....

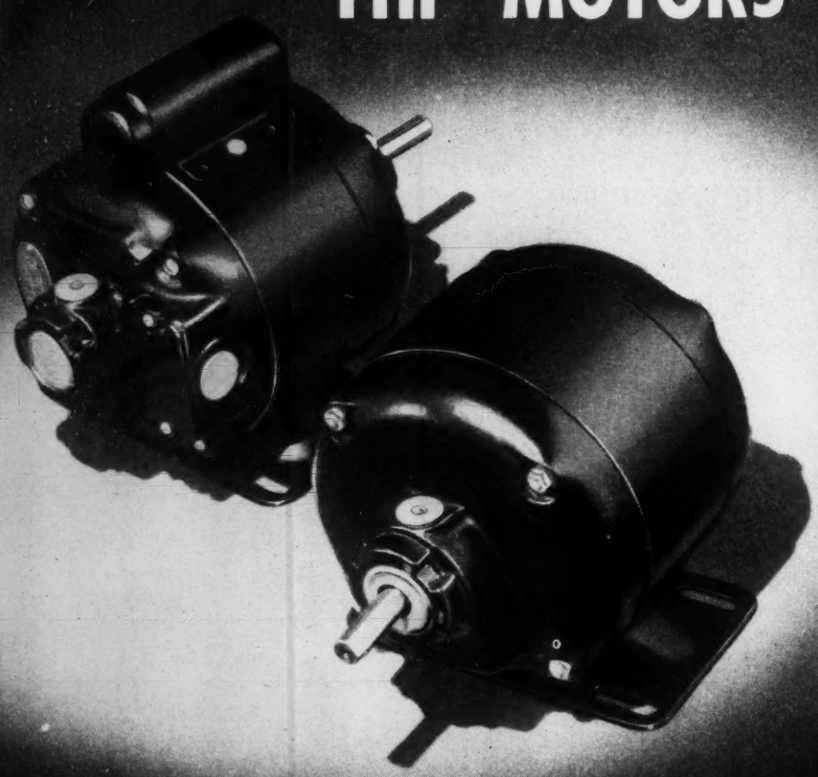
Firm .....

Address .....

080-177

GENERAL ELECTRIC

LOW-MAINTENANCE FHP MOTORS



FOR HEAVY-DUTY SERVICE

- DAIRY EQUIPMENT
- DRY-CLEANING EQUIPMENT
- GREASE GUNS
- LIFTS AND HOISTS
- MACHINE TOOLS
- METALWORKING MACHINES
- PUMPS AND COMPRESSORS
- SHOE MACHINERY
- TEXTILE MACHINERY
- WOODWORKING MACHINERY
- LAUNDRY EQUIPMENT

WHETHER for start-and-stop service on lifts and hoists or for continuous duty on pumps and compressors, General Electric fractional-horsepower motors will operate your machines long and dependably with little or no attention. Their construction embodies years of experience in building motors to meet the load demands and conditions encountered in applications like those listed above. Large overload capacity is provided for peak loads. Bearings are large and require only occasional oiling. The latest type of insulation — resistant to moisture, oil, and mild acids and alkalis — is used.

Standard G-E motors with the proper electrical characteristics and mechanical features are available for *your machines* — motors with high or low starting torque; motors that are dripproof, explosion-proof, or totally enclosed; motors for solid, resilient, flange, or vertical mounting; to mention but a few. Speed ratings range from 3450-rpm, two-pole motors to 5.7-rpm gear-motors. For additional information on G-E motors, contact the nearest G-E sales office or write to General Electric, Schenectady, N. Y.

SEE THE G-E "HOUSE OF MAGIC" AT BOTH FAIRS

ANY TYPE YOU NEED

SPLIT-PHASE MOTORS
Moderate starting torque
Single-phase

CAPACITOR-MOTORS
High starting torque
Single-phase

GEAR-MOTORS
Single-phase, polyphase, or direct-current

POLYPHASE MOTORS
Same mounting dimensions and characteristics as other G-E Motors

DIRECT-CURRENT MOTORS
Interchangeable with a-c motors

GENERAL ELECTRIC

070-280

$5.00 won't buy it—

Here's an engineering omnibus for users and designers of all types of household appliances and small machinery.
Instantly selects without calculation the drive for any small machine.
Contains over 165,000 drive combinations in the belt drive tables alone.
All fractional horsepower ratings! All speed ratios! Any center distance!
Gives dimensions, prices and essential engineering data together with complete list of Fractional Horsepower V-Belts and V-Pulleys.
Lists variable Pitch Pulleys for all Fractional Horsepower V-Belts.
Lists standard pulley combinations in sequence of pulley sizes.
Compact, practical, saves time, trouble and grief.
Dayton
V-BELT DRIVES
For Fractional Horsepower Service
But it's
FREE TO YOU
THIS NEW Dayton
FRACTIONAL HORSEPOWER CATALOG No. 150

Perhaps you know that Dayton Standard Fractional Horsepower V-Belt Drives simplify design, reduce costs and assure maximum service. You may be familiar with the patented construction of Dayton V-Belts which give greater strength and endurance. If so, you know that Dayton V-Belts do not squash, twist, vibrate or stretch. They work on extremely short centers. They have extreme crosswise rigidity.

Yet you couldn't possibly have at your finger tips all of the information that's crammed into the engineering omnibus which is Dayton's new Catalog No. 150. In one of its sections over 165,000 drive combinations are shown in the belt drive tables alone. A few of the highlights of No. 150's contents are shown on this page. But only a study of the catalog, itself, will reveal the priceless information it contains.

For instance, the reference tables in sequence of pulley sizes are of tremendous help to the machinery designer in laying out drives for a range of machines to be made on a production basis. Or, if you are developing a machine to be made in *quantities*, yet one which will be operated at different speeds and capacities, the reference tables automatically give the required information.

Dayton Fractional Horsepower V-Belts are made in *three* standard sections in a complete range of lengths to meet all conditions of small machinery service. They are being used on everything from oil burners to office appliances . . . from stokers to shoe machinery . . . from compressors to coffee mill machinery . . . for household pumps, display fixtures, laundry, textile, tanning machinery and for hundreds of other uses. So, whether you make or use small machinery or household appliances, remember that $5.00 will not buy the Dayton Catalog No. 150, but it is yours *free*.

Write for it today!

Dayton

V-BELT DRIVES WITH DAYTEX CORD

MADE BY THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

GIVE THIS TO YOUR SECRETARY—

Write today for Catalog #150 (the Engineering Omnibus) just issued by

THE DAYTON RUBBER MFG. CO.
DAYTON, OHIO

* **Whether for fractional or a thousand horsepower there is a Dayton V-Belt Drive for the job.**

RESPONSIVENESS

HELE-SHAW *Fluid Power* HAS IT!

The alert way a dog obeys every command of his master closely parallels the responsiveness of a Hele-Shaw Pump. At the simple shift of a lever, turn of a wheel or touch of a button, Hele-Shaw Fluid Power starts, stops or reverses. It does these things instantly or gradually—depending on the type of Hele-Shaw Regulator used—and without complicated electrical or mechanical controls. Nimble responsiveness is but one of the many practical, usable advantages of Hele-Shaw Pumps and Fluid Power (oil under pressure for driving machines). Make a point of investigating these advantages for machines you design, build or buy. Ask us to show you how we can put Hele-Shaw Fluid Power to work for you.

Other A-E-CO Products: Lo-Hed Hoists, Taylor Stokers, Marine Deck Auxiliaries.

A-E-CO Hele-Shaw FLUID POWER

AMERICAN ENGINEERING COMPANY

2502 ARAMINGO AVENUE, PHILADELPHIA, PA

EASIER TO INSTALL

...easier to use!

LARGE WIRING SPACE

Type SD push button cases are small and compact, yet provide ample wiring space inside around entire button unit. Knockouts at top and bottom make wiring easy.

Control circuits are easier to wire . . . easier to operate . . . with new Westinghouse Type SD Push Buttons. Their rounded, compact design saves space . . . their clearly numbered terminals make wiring simple. Symmetrical design allows mounting with either end up. Once installed, the generous-sized buttons, shrouded to prevent accidental operation, insure handy, convenient and dependable performance.

Type SD push buttons are available in single, double and multiple circuit stations, in special mountings and as units for built-in applications. Write for the new bulletin describing them — ask for bulletin 15-020

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Dept. 7-N.

J-20882

Westinghouse
Type SD Push Buttons

W
WESTINGHOUSE ELECTRIC

Topics

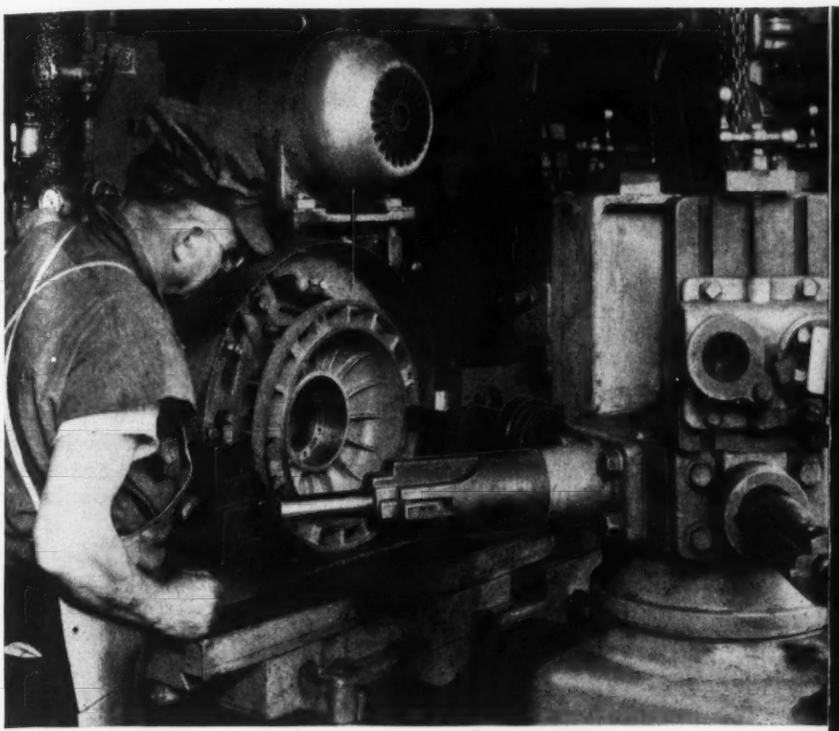
DEVELOPMENT of useful byproducts from waste materials is one indicator of an efficient industrial system and has been responsible for such common derivatives as byproduct coke, aluminum (from bauxite), and the host of coal tar-base materials. As one of the most recent phases of this trend, plastics have provided continually amazing results. Within the last year three plastics have come forward which show what can be done by research. One company is delving into the possibilities of a plastic made from bagasse, the residue of sugar cane after the latter is crushed in mills. Because it is ridiculously cheap and abundant, bagasse's usefulness was early recognized by companies like Celotex, which processes it into composition sheeting for walls and roofs. Lignin, which constitutes about one-fourth of all wood bulk, once was discarded after cellulose had been extracted from wood for paper or rayon making. Another firm has made a successful plastic, whose uses are not fully apparent yet, by combining lignin with hydrogen. And at the summer's end information became available on Mazein, a protein (prolamine) found in corn and extracted from corn gluten meal with aqueous-alcohol, recovered after purification as a fine powder. By mixing Mazein with 20 per cent water and 5 per cent formaldehyde, a plastic molding material is produced, characterized by ease of machining, toughness, high mechanical strength, fair water resistance. To prove its versatility, Mazein may be used also as a glossy finish on labels, as an adhesive, and as a strengthener for aniline ink used in color printing.

♦

DIESEL-POWERED locomotitves with electrical drives have come to enjoy great popularity in the railroad field, but some objections have been voiced by maintenance men on the grounds they were not sufficiently familiar with the electrical devices. Moreover, a wide variation in efficiency at different road speeds is frequently noted. An answer to this problem was demonstrated recently in the form of a diesel locomotive with an hydraulic transmission. Said to be the first such machine in the United States, the locomotive is equipped with an hydraulic torque converter connected to a two-speed gearbox. (Principles of torque converters were discussed in M.D., June, 1939, page 39.) Advantages of a locomotive so equipped include: Increased efficiency, full engine power at starting, more smooth application of power, unlimited torque increase. The two-speed gearbox, consisting essentially of gears, clutches and antifriction bearings, is also hydraulically operated and affords a further increase of maximum torque of two to five times. Clutches are protected by the converter, inasmuch as most of the slip during engagement and acceleration is taken up by the converter, and the clutches may therefore be of the quick-gripping type. The gearbox is bolted directly to the converter housing.

♦

IN the article in the August issue of M.D., *How Smooth Is Smooth?,* attention was called to various methods for measuring actual roughness of a surface. Development by J. A. Sams, General Electric laboratory, of an instrument which records variations of as little as one-millionth of an inch is a contribution to further progress along this line. It is especially suitable at present for indicating smoothness on the surfaces of bearings, moving parts of motors, and the like which are subject to wear. Appearing somewhat like a phonograph, the apparatus has a turntable on which the object to be tested is placed, and a sapphire-pointed stylus which passes over the material as it revolves. Small mechanical impulses are created as the hard point rides over irregularities and these impulses are transmitted to an electromagnetic pickup which converts them into electrical impulses. Amplified, the latter are transmitted to a recording meter. So sensitive is the stylus that it will record the vibrations set up by a person whistling.



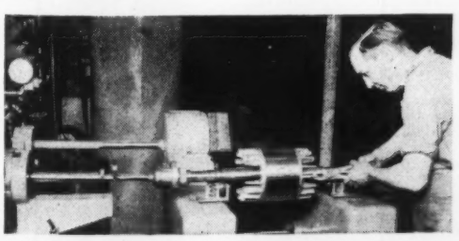
FRIENDLY RELATIONS

End frame—ball bearing cartridge —ball bearing

Accurate machined surface relation between end frame, ball bearing cartridge and ball bearing is accomplished by the common Delco practice of grouping operations. Turning operations on motor end frames are done in one operation, and turning and boring operations on ball bearing cartridges are completed in one setup, as shown here. Delco ball bearing cartridges are machined to the tenth of a thousandth of an inch, to insure the proper fit of a selected bearing.

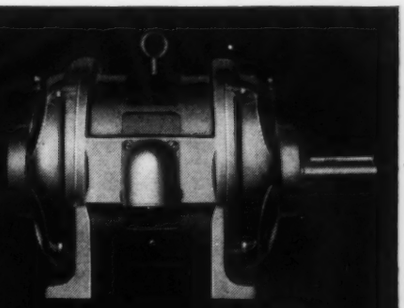
On sleeve bearing types, the end frame is machined in the same manner, and the oil reservoir is thoroughly cleaned and lacquer-sealed at high pressure. After the babbitt-lined bearing is pressed into place, it is diamond-bored to very close limits, insuring an inside diameter concentric with the register on the end frame.

Delco urges prospective motor purchasers to consider what this precision workmanship means to their lasting satisfaction, and to *look within* the motors they specify.

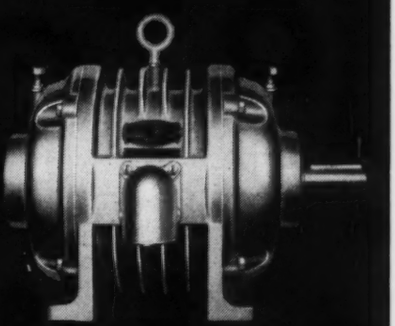


EVERY DELCO MOTOR IS DYNAMICALLY BALANCED

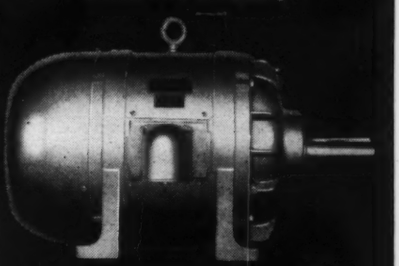
No motor leaves Delco Products that has not been dynamically balanced on a specially-designed balancing machine. Delco balances every motor. Each end of the rotor and shaft is first balanced independently, while the machine indicates exactly how much compensation is required and where it should be applied. After all adjustments have been made, the complete rotating assembly is given a final check. Delco motors assure satisfactory balance.



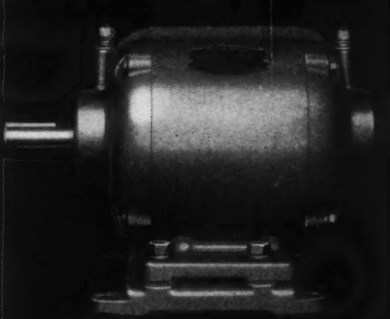
Open Frame, Sleeve or Ball Bearing



Totally Enclosed Ball Bearing



Totally Enclosed Fan-Cooled Ball Bearing



Fractional Horsepower Motor

• • •

Delco industrial AC motors are available in various types, possessing electrical and mechanical characteristics to meet practically every requirement.

Normal starting torque—normal starting current—high starting torque—low starting current—as well as high slip. Each type available in open frame, sleeve or ball bearing—totally enclosed ball bearing—totally enclosed fan-cooled ball bearing—also multi-speed motors. Electrical and mechanical modifications available. Delco motors comply with NEMA standards.

DELCO MOTORS

DELCO PRODUCTS

DIVISION OF GENERAL MOTORS CORPORATION

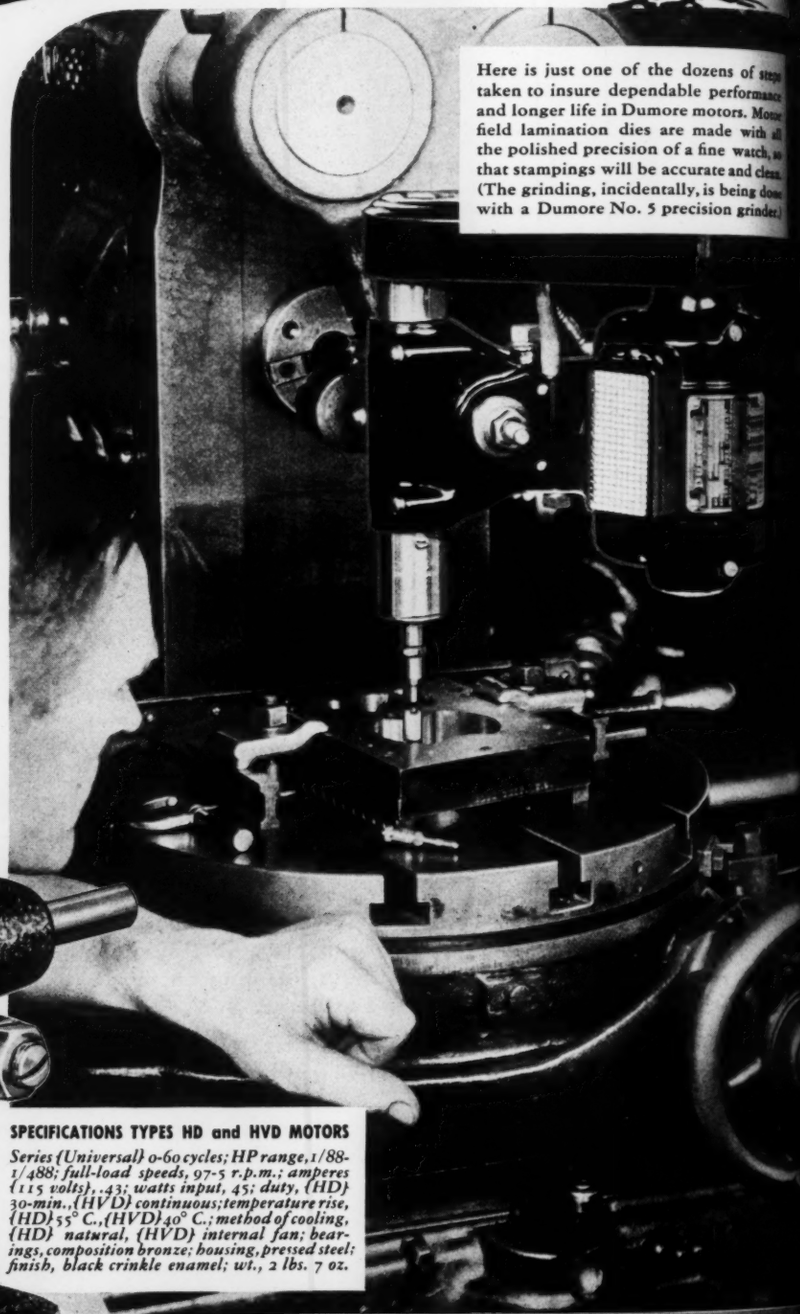
DAYTON, OHIO

THERE ARE 30 Hours IN A DUMORE DAY

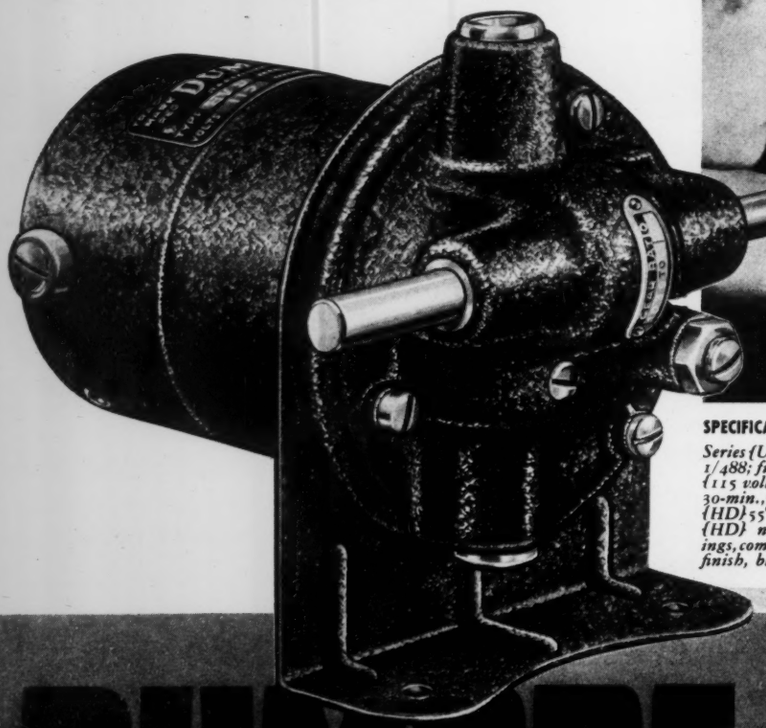
Ordinary measures of time and of work done are not enough for Dumore motors. For into every Dumore unit goes the most exacting production practices known to modern engineering, proved and perfected by 25 years of laboratory study and field experience.

You get out of a motor only what has gone into it. Here's what goes into a Dumore to give you many extra hours of power: (1) Armatures dynamically balanced to eliminate vibration; (2) Commutators ground concentric with bearings for longer life; (3) Windings expanded at high speed, then sealed; (4) Leads swaged by special process for 100% electrical contact; (5) Every motor run-in to seat brushes properly; and (6) Every motor inspected five times during manufacture. Let Dumore look at your power problem. Write for engineering service blank.

THE DUMORE COMPANY • Dept. 129-L Racine, Wis.



Here is just one of the dozens of steps taken to insure dependable performance and longer life in Dumore motors. Motor field lamination dies are made with all the polished precision of a fine watch, so that stampings will be accurate and clean. (The grinding, incidentally, is being done with a Dumore No. 5 precision grinder.)

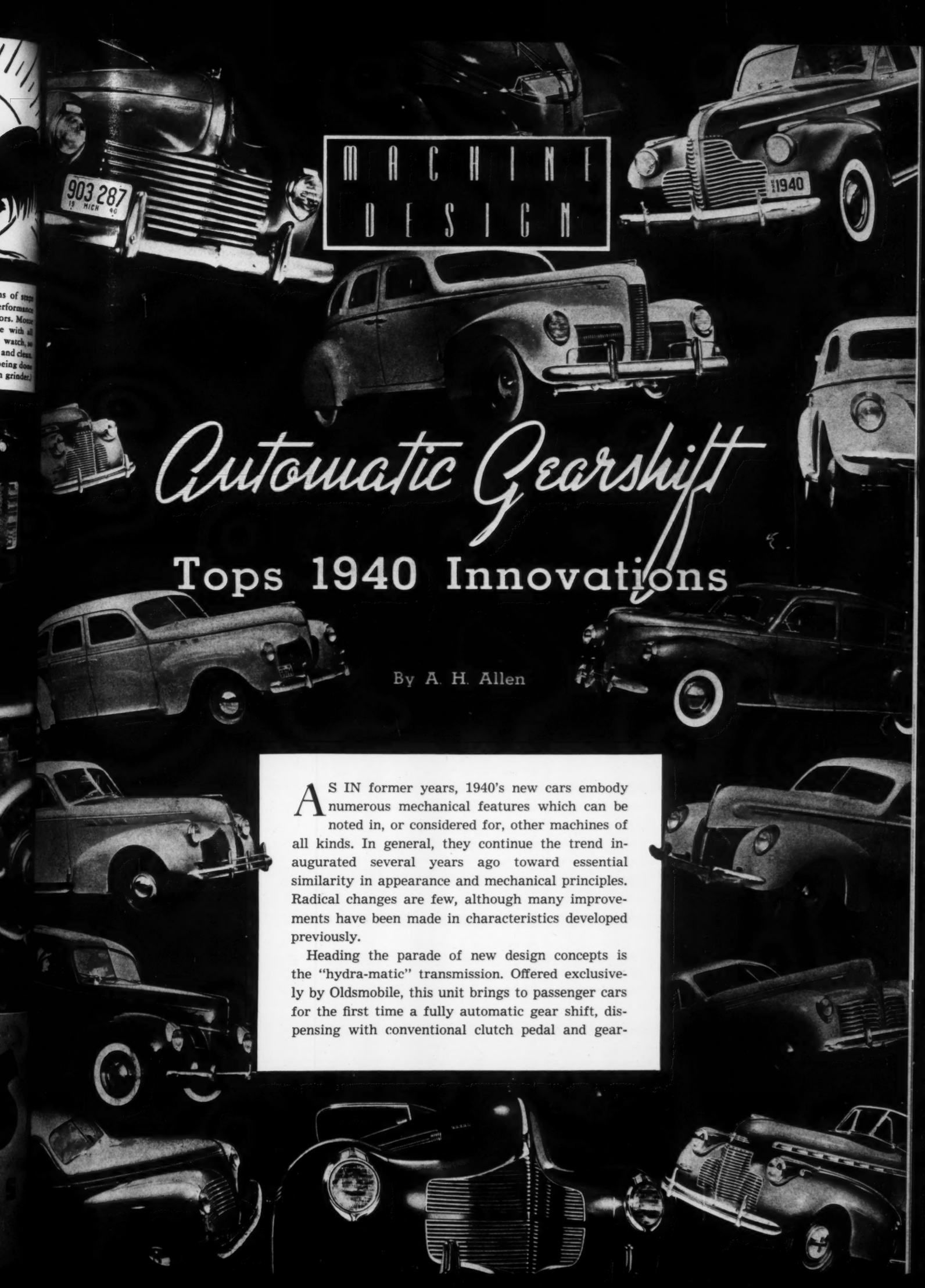


SPECIFICATIONS TYPES HD and HVD MOTORS

Series {Universal} 0-60 cycles; HP range, 1/88-1/488; full-load speeds, 97-5 r.p.m.; amperes {115 volts}, .43; watts input, 45; duty, {HD} 30-min., {HVD} continuous; temperature rise, {HD} 55° C., {HVD} 40° C.; method of cooling, {HD} natural, {HVD} internal fan; bearings, composition bronze; housing, pressed steel; finish, black crinkle enamel; wt., 2 lbs. 7 oz.

DUMORE MOTORS

FOR Extra POWER HOURS



Automatic Gearshift

Tops 1940 Innovations

By A. H. Allen

AS IN former years, 1940's new cars embody numerous mechanical features which can be noted in, or considered for, other machines of all kinds. In general, they continue the trend inaugurated several years ago toward essential similarity in appearance and mechanical principles. Radical changes are few, although many improvements have been made in characteristics developed previously.

Heading the parade of new design concepts is the "hydra-matic" transmission. Offered exclusively by Oldsmobile, this unit brings to passenger cars for the first time a fully automatic gear shift, dispensing with conventional clutch pedal and gear-

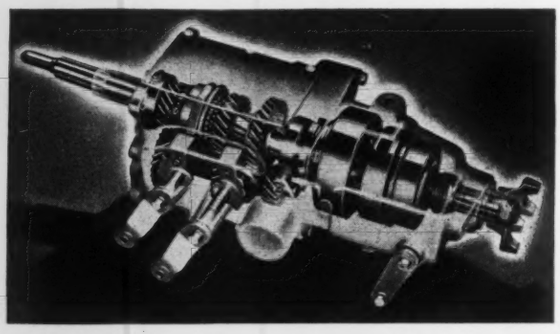
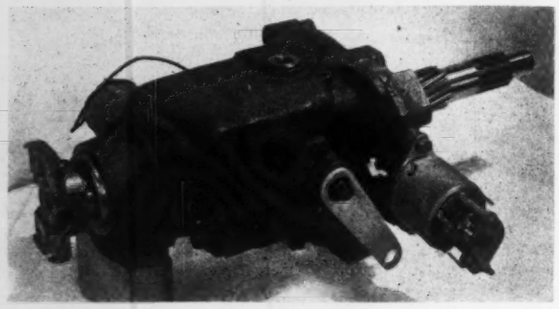


Fig. 1—Phantom view of the Studebaker overdrive transmission, changed from horizontal to vertical position. Fig. 2—Below—Overdrive for the 1940 Packard transmissions, showing solenoid cutout



shift lever. Controls are reduced to the brake pedal, accelerator pedal and a lever on the steering column with four positions—neutral, high, low and reverse. In normal driving operations the lever is set in the high position and the transmission shifts automatically and hydraulically through first, second and third gear ratios, finally going into fourth speed or direct drive with a rear axle ratio of 3.6 to 1.

Essentially the transmission comprises three elements—hydraulic control system, gearbox and fluid coupling. The hydraulic control system, *Fig.* 8, supplies oil pressure at the proper time to actuate clutch pistons and brake bands of the planetary gear units in the transmission proper, thus hydraulically controlling the change in gear ratios. Arrows in the illustration show the flow of power in first gear. Rotating parts shown by double hatch sectioning.

Basically the system is an arrangement of balanced valves, oil being admitted to and directed between inlet and exhaust openings to balance the force exerted by spring pressure in the case of the throttle valve, or by centrifugal force in the case of the governor valves. The former valve is controlled by position of the throttle, the governor valve by the speed of the centrifugal governor driven by the transmission output shaft. When the governor valve pressure exceeds that of the throttle valve pressure, the shift is made from one gear ratio to the next. Thus, under light throttle, the shift from first to second is made at about 7 miles per hour, from second to third at 13 miles per hour, from third to direct drive at 23 miles per hour. Under full throttle, however, these speeds are boosted considerably—from first to second at 15, from second to third at 30, and from third to direct at 65 miles per hour.

The gearbox includes two planetary units for forward speeds, each having an internal gear, three planet pinion gears, sun or center gear, brake drum and band, and clutch. For reverse, there is an additional planetary set which is compounded with the rear planetary unit used for forward drive; it includes an internal gear, three planet pinions, and sun gear. On the outer circumference of the internal gear forging there are also external teeth into which a sprag is engaged when the car is shifted into reverse. Drive gear of the front planet carrier is keyed to a tubular shaft splined to the hub of the fluid coupling cover; the planet pinion spider is splined to the rear rotor of the fluid member.

This construction is necessary because power flows from the engine through the fluid clutch cover to the first planetary unit, then (in first and second gears) through the fluid member, then back again through a main shaft to the sun gear of the rear planetary unit. In third and fourth gears, the torque flows partly through the fluid unit as it does in first and second gears, but also is transferred through the intermediate shaft, through the engaged clutch of the rear unit into the internal gear. In any case, the final output is through the planet carrier of the rear unit.

In this transmission the fluid coupling has been designed to overcome objections of too much creep at idling speed and too much slip under normal high gear driving conditions. It contains the usual two rotor units or "torus" members of stamped heavy-gage steel, each carrying 48 equispaced vanes of thin-gage steel, and held rigidly in position by annular rings or torus rings of pressed steel, slotted to hold the edges of the

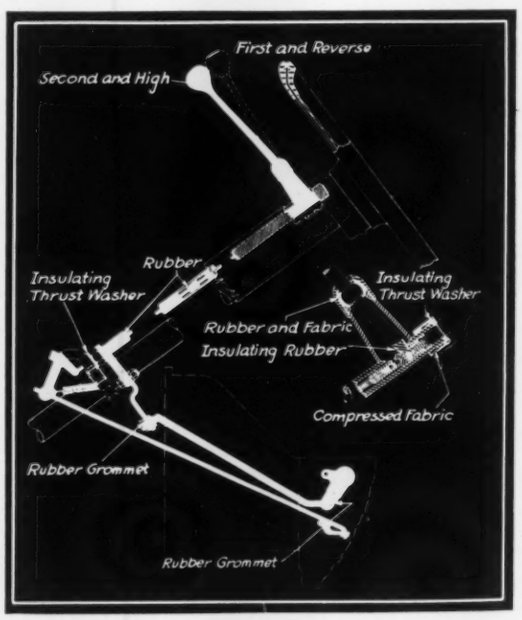


Fig. 3—Details of Buick gearshift linkage showing how rubber and fabric bushings and washers are used to avoid metal-to-metal contact

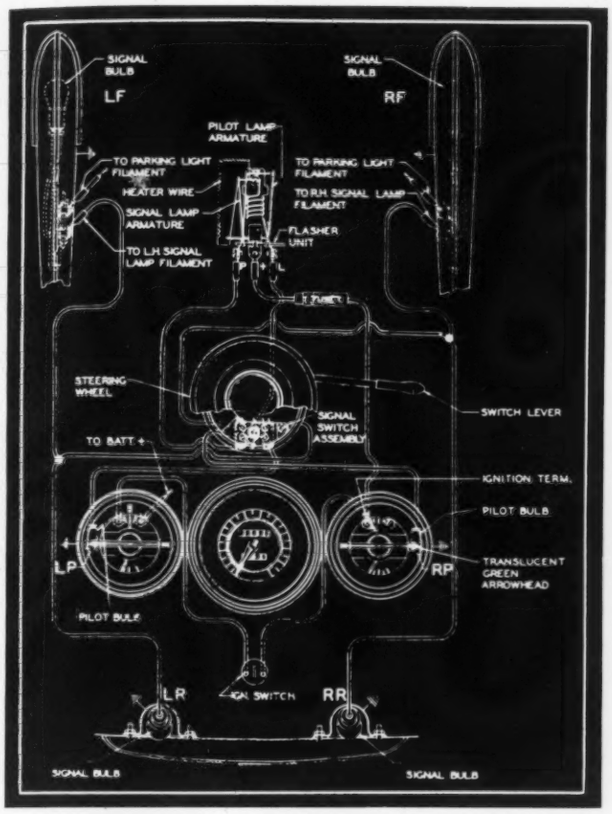


Fig. 4—Wiring diagram showing how flasher mechanism is incorporated in front, rear and dash signal lights. Note switch lever

vanes. Shape of the torus rings and area of the passage between the vanes has been designed to give least possible restriction to flow of oil.

The fluid coupling is filled with oil under pressure of 30 pounds supplied by one of two oil pumps required to supply hydraulic pressures in operating the transmission. Ten quarts of oil are needed by the complete transmission, six being utilized by the fluid coupling. Surrounding the coupling is a pressed steel housing through which engine power is bridged across the fluid member. Over the whole is the cast iron outer housing.

Refinements in transmission and overdrive designs for 1940 models are numerous. Several makers offer overdrives as optional equipment. In general, overdrives have been designed to cut in at lower speeds than formerly, giving the advantage of their added economy in the normal "traffic" range of driving. Two examples are shown in *Figs.* 1 and 2.

Nash has a cut-in speed of 32-35 miles per hour instead of 40-45 miles per hour as last year, the usual buttton on the dash permitting locking out the automatic fourth speed. Continued this year is the automatic overtake which cuts out the overdrive action when the accelerator pedal is depressed to its full extent.

Transmissions on the entire Chrysler line have been altered with the idea of making them uniform and interchangeable. A new type of synchronizer has been developed and new tooth pointing used on first and reverse gears, as well as wider teeth. The gears are given an airless grit "blasting" after heat treatment, serving to remove all traces of tool marks or scratches which might be the focal points of subsequent fatigue failure. For the same reason grit blasting is being applied to other steel parts, notably rear axle pinion and ring gears and silicomanganese steel rods used in coil springs.

Chrysler transmission controls enter the case through the left side instead of through the top. Transmission tail shaft is longer, passing through a cast housing bolted to the rear of the case before being joined to the propeller shaft. Use of this extension housing permits quick installation of the overdrive on those models carrying this accessory, and avoids the need for changing length of propeller shaft. The Chrysler overdrive, incidentally, cuts in at 23-28 miles per hour and out at 18-24 miles per hour.

Complete redesign has been worked out for body and chassis arrangements on the Chrysler 1940 line of cars. To provide a smoother ride the rear axle has been moved back about 7½ inches on the frame and the front axle back about 4 inches, yielding a 3-inch increase in wheelbase without any increase in overall length. This change, *Fig.* 5, permits straight-sided rear doors on four-door sedan models, the rear edge of the door clearing the wheel housing. No change is re-

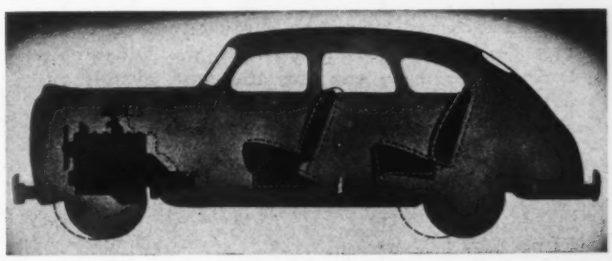
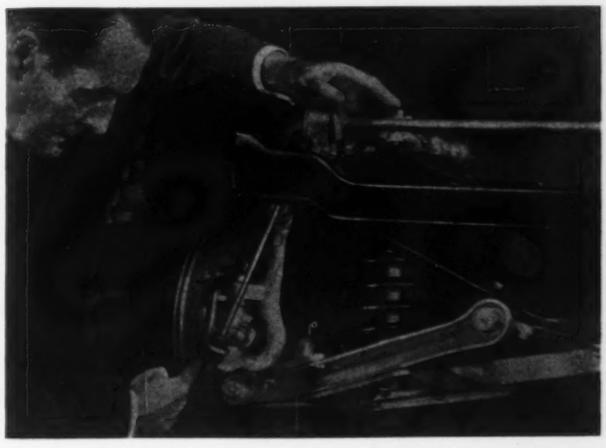


Fig. 5—Plymouth and other Chrysler models have relocated wheels, seats and engines with respect to chassis, aiming for scientific weight distribution to improve riding comfort. Fig. 6—Below—Front suspension on Hudson models is of the coil spring and wishbone type with shock absorbers mounted coaxially inside the springs



quired in the length of the propeller shaft, the extension housing on the transmission case taking up the increase in wheelbase. The accompanying shadow illustration gives a good idea of the new interrelation between engine, seats, wheels and body, dotted lines representing the position of these elements in 1939 models.

Numerous other refinements in springing and suspension systems aid better riding. Nash has changed front suspension to the familiar coil spring and wishbone supporting arm type. Hudson has done likewise, but also has ingeniously mounted low-pressure shock absorbers coaxially inside the spring coils, a simple and compact method, *Fig.* 6.

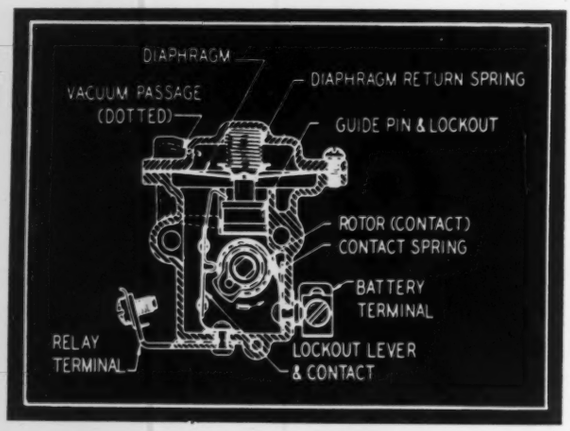


Fig. 7—Details of construction and operation of the new vacuum starter switch designed for one car. Fig. 8—Below—Cross section of the Oldsmobile hydra-matic drive showing the fluid clutch and planetary gear units, arrows indicating the flow of power in first gear. Rotating parts are shown by double hatch sectioning. Ratios change hydraulically

Reasoning that a front suspension system positioned to effect a slight "give" with road bumps would be less apt to transfer "road thump" to the passenger compartment, Buick engineers rotated the angle of suspension backward 4 degrees. The resultant effect is likened to a boxer's "rolling with the punch."

Rear springing systems likewise have been modified, Packard and Hudson using longer leaf springs, with a periodicity more nearly like that of the front coil springs. These longer and softer springs naturally call for reinforcements in shock absorbers and stabilizers, as in the Ford and Mercury examples, *Fig.* 10.

Buick has completely redesigned its rear suspension, mainly as the result of a change to long, single torque tubes and propeller shafts instead of the divided type used previously. The change has placed the universal joint and torque ball directly back of the transmission and the longer torque tube provides more leverage against road bumps and also produces less upward force of the torque tube on the torque ball. Diameter of the propeller shaft has been increased from 2 to 2¾ inches, and of the torque tube from 3 to 3⅜ inches. A comparison of 1939 and 1940 systems is given in *Fig.* 9.

Rear coil springs have larger diameter, 5½ inches inside, and are installed above the rear axle 3 inches closer than formerly to the center line of the housing. This change, combined with the greater length of the torque tube, has a decided effect upon the upward force of the torque tube at the torque ball, produced by the weight of the body and frame pivoting about the center line of the axle. It has reduced this

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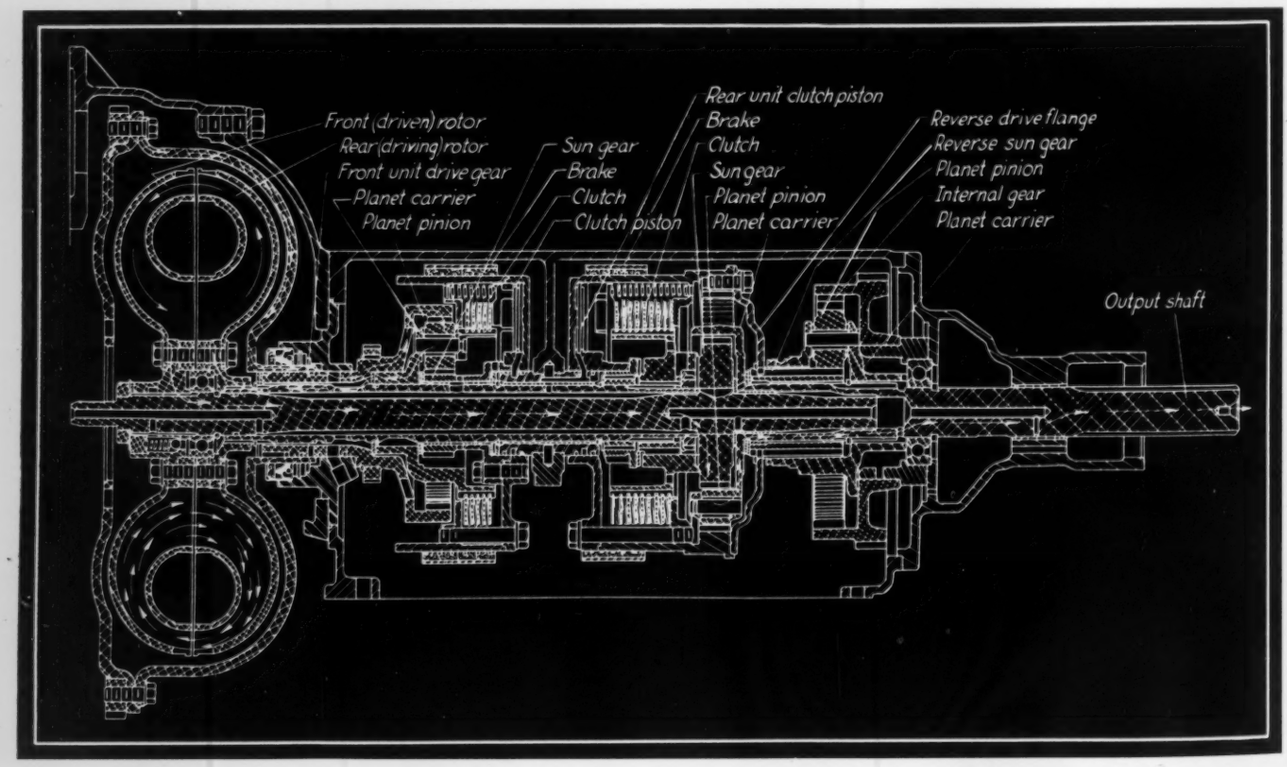


Scanning the Field FOR IDEAS

Measures Varying Volumes

WHEN desirable to measure the quantity of a material passing a certain point as for instance coal or grain on a conveyor, it is necessary to employ a counter capable of integrating the volume even though the velocity of the conveyor and height of the material may vary. A proportionate counter developed for this purpose is shown schematically in *Fig.* 1.

Swinging on a fixed horizontal hinge, a door is so

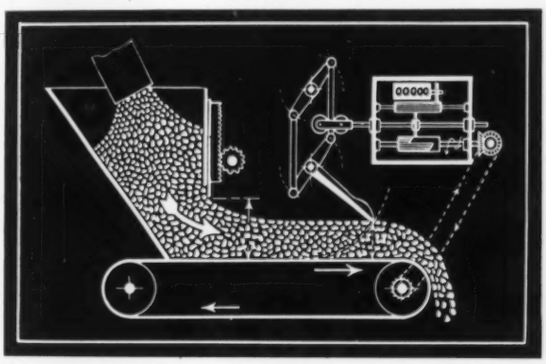


Fig. 1—Spiral gear on counter integrates volume

arranged with a counter element that, as changes in height of the material occur, the door rises and falls accordingly. A draw-bar with a thin sprocket wheel affixed is shifted in a fixed ratio by rocker arms as shown in the drawing.

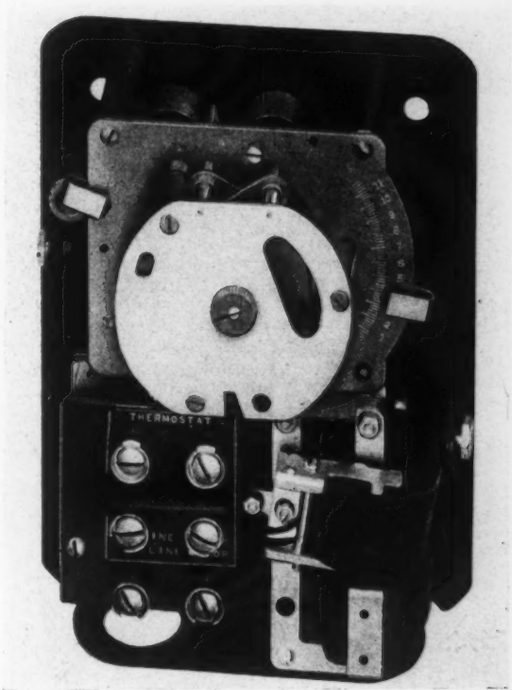
Cylindrical wheels above and below the sprocket wheel and meshing with it are provided with long horizontal teeth. However, while the long teeth of the upper one extend the full length of the cylinder and thus provide a complete cylindrical surface of teeth, the toothed surface of the bottom wheel is cut away in such a way as to have a full circle of short teeth at one end of the cylinder and none at the opposite end. Effect of shifting the sprocket is to provide continuous transmission at one end and none at the other corresponding to maximum flow of material and no material.

Teeth are cut out spirally as shown so that the sprocket wheel integrates the volume of material passing as the spirally toothed drum rotates proportionately with the speed of the conveyor. Then by proper selection of gearing the counter may read directly in volume or weight as desired.

Bimetal Operates Heat Motor

UTILIZING a slow speed heat motor, the timing switch shown in *Fig.* 2 is quiet in operation, requires no lubrication and has only one rotating part making one revolution an hour. In this way an unusually simple design is effected without use of gearing. The switch is suitable for timing operations

Fig. 2—Heat Motor for timing device operates at one revolution per hour



where high accuracy of cycle timing is not required, as for a stoker control.

Two loop shaped bimetal coils operate the motor. Alternately heated, one loop is heating as the other is cooling. Both move accordingly and supply power to a ratchet mechanism which is connected to the rotating member. When the difference in temperature between the coil being heated and the one cooling reaches a certain point, a snap action device flips the heater element away from one coil and against the other which has been cooling. This process of heating and cooling causes rotation and cycle timing according to the dial settings.

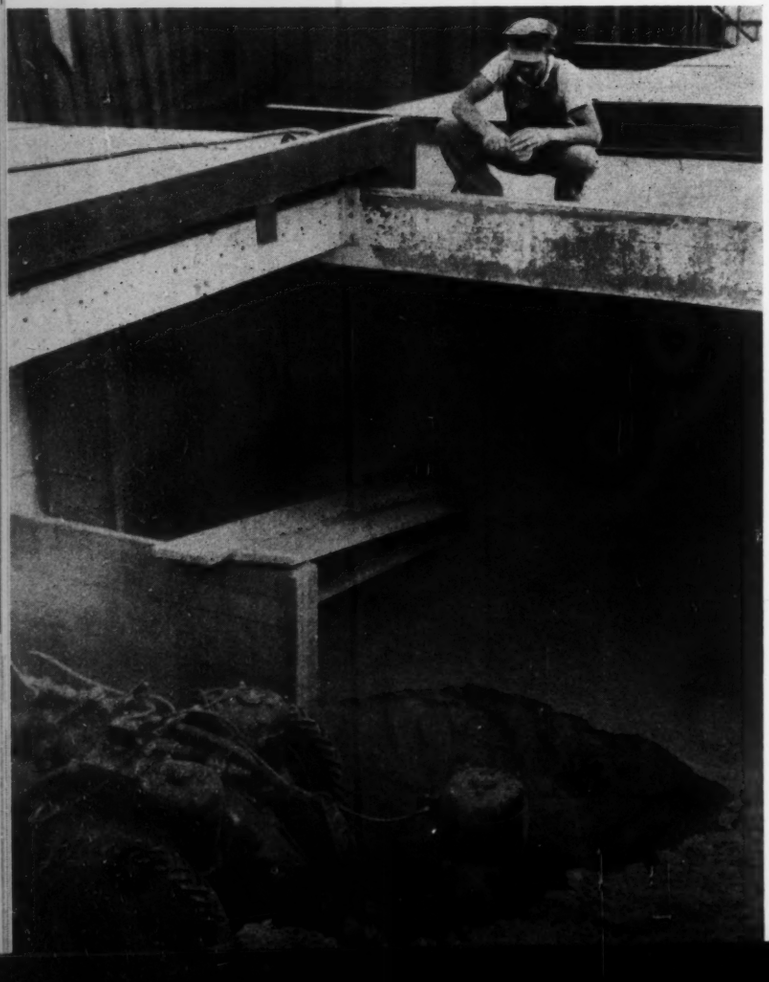
The heater element circuit is permanently closed eliminating contacts and radio interference. Furthermore there is less strain on the insulation of the heater because it is not subjected to stresses caused by opening and closing its circuit. The mechanism automatically compensates for ambient temperature since it operates on differential temperature between the two bimetal coils. However, variations in line voltage affect the timing somewhat. Lower voltages make the motor developed by Mercoid Corp. operate slower, higher voltages increase the speed slightly.

Veneer Extends Stainless Use

FOR lightweight panels, enclosures for thermal or sound insulation, chutes or surfaces of conveyors, etc. a new material has been developed comprising a thin layer of stainless steel permanently bonded to an inert mineral backing. The stainless steel surface makes this material especially useful on dairy, food and hospital machines were easily cleaned surfaces, low cost and easily fabricated materials are required.

Known as Ludlite Bord, sheets have a facing of .0095-inch thickness of stainless steel. The mineral backing consists of asbestos fibers, Bentonite (volcanic clay, portland cement and calcined magnesite processed under pressure to form semirigid, flat sheets. The coefficient of expansion of the backing closely approximates that of the stainless so no distortion occurs under ordinary temperatures. Although the material absorbs moisture, such absorption does not cause warpage.

Sheets of ⅛-inch in thickness are flexible enough to be bent to suit requirements without losing flatness. The ¼-inch panels are rigid and possess high load bearing strength. The material is easily fabricated; it may be sawed, drilled or sheared and for some purposes stamped. Joints may be soldered or welded. Developed by the Ludlite division of Allegheny Ludlum Steel Corp., Pittsburgh, this material is relatively inexpensive when compared with solid stainless steel sheets.



Unique Control Uses Mercury Switch

CONTROL of machines often involves complicated relaying systems and delicate mechanisms. An extremely simple device, however, which is both novel and interesting is a remote control for a bulk cement unloader recently developed. Advantages of this control are apparent in *Fig.* 3, showing unloading operations in the hold of a river barge. In addition to providing safety from dust hazard, remote control allows the operator to sit comfortably at a vantage point and direct the machine at will.

Both wheels of the unloader are driven separately and are controllable from the operator's station. Four mercury switches are arranged 90 degrees apart around the control device shown in the operator's hand. Each switch controls a movement—forward, backward, right turn, left turn—and is so positioned that the device need only be pointed toward the direction in which it is desired to move the unloader to obtain a corresponding response. The resulting tilting causes mercury to close the proper switch. Right and left turns are executed by reversing the direction of rotation of the wheels. For instance, on a right turn the left wheel rotates forward and the other backward. This application of mercury switches was developed by Fuller Co. in conjunction with Durakool, Inc.

Fig. 3—Operator controls unloading machine by pointing control handle in direction he wishes machine to operate

Attractive Nameplates Enhance Appearance

By Harold Van Doren*

Harold Van Doren & Associates

IT IS important that machines be quickly and easily identifiable. It is equally important to treat identification marks and other data in such a way that they fulfill the function the machinery manufacturer expects and yet be an integral and attractive part of the entire design.

Nameplates, patent numbers, style letters, instructions for operation, etc. are some of the marks borne by almost every machine. Some must be visible, others may be partially concealed or entirely hidden. All markings visible to the eye, however, are an important part of design and should receive thoughtful attention from every manufacturer.

Fig. 1

Treated in this article are three general classes of identification markings. They are:

1. IDENTIFICATION MARKS, including tradenames, style names, trademarks, and devices in various combinations.
2. DATA PLATES, including patent and inspection data, maker's name and address, instructions for operation, warning notices, underwriters' approval, etc.
3. OPERATING ACCESSORIES, including dials, timing devices, switch plates, thermal indicators, control panels, etc.

Often such devices are included on the nameplate in combination with the trademark as in *Fig.* 1.

For the sake of brevity all marks in class 1 will be referred to as nameplates whether they are trademarks, tradenames, model names, or the company names. If expertly handled the nameplate may be the focal point of an entire design, or, if identification should be "played down" due to the particular type of machine, it may be made inconspicuous and yet be visible to the eye.

The prominence given to the nameplate varies to some extent with its use. In consumer merchandise it must not be made too insistent. There is a tactical error in converting a device into a signboard; the consumer resents it. In fact certain types of domestic equipment should bear no visible identification at all. Such items are usually marked underneath, inside, or not at all.

Capital goods, on the contrary, may be labeled boldly and without restraint, but it is best to evolve a theme of treatment which will identify your machinery without resorting to over-prominent labeling.

Nameplate shapes must be chosen with two points

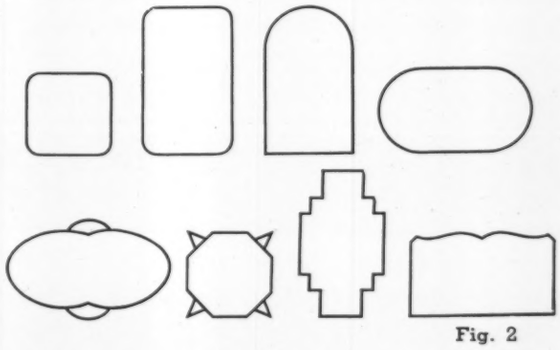


Fig. 2

* The author's forthcoming book, *Industrial Design—A Practical Guide,* to be published by the McGraw-Hill Book Co., New York, will contain a chapter based upon material similar to that contained in this article.

Fig. 3

Fig. 4

in mind: (1) Fitness to the material (lettering, trademark, or device) which the outline encloses; (2) fitness of the nameplate outline to the entire unit. Sometimes it is no simple matter to reconcile the two. The machine may have a long name, and yet the ideal shape to harmonize might be a circle. Or perhaps the manufacturer has an established trademark in some tall vertical form, whereas a plate in the shape of an elongated rectangle or ellipse is required.

Design Should Be Simple

If the nameplate is to become the focal point of a design, the prime rule is to make it *simple*. This applies not only to its outline or "silhouette," but to the material within the outline, whether it be lettering, emblems, or symbolic devices. If lettering predominates, it is sensible to make it as legible as possible. Other elements should be conventionalized. Broad masses can be played up, fussy detail avoided.

Color, too, should be simple. Metal plus one color is all that is needed to make a striking nameplate. Two colors should be about the limit, not only to avoid confusion but to keep costs down.

BASIC SHAPES: The basic shapes—triangle, square, rectangle, circle, ellipse—might be used for nameplates. Any one is good in itself or certain modifications may safely be made. Some of these modifications are indicated in *Fig.* 2, top row. Outlines should not be complicated, however, by combining shapes injudiciously, or by adding bumps, angles, and whatnots under the mistaken impression that it will make the design more "artistic." Indicative of these errors are the outlines in *Fig.* 2, bottom row.

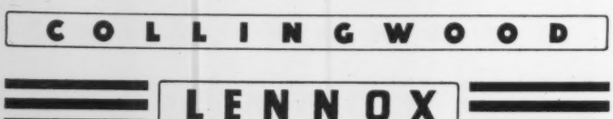


Fig. 5

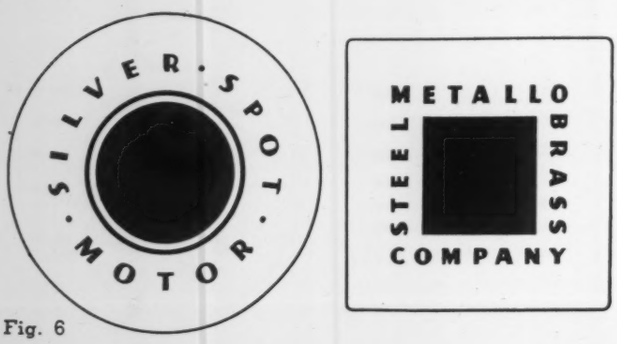


Fig. 6

To describe and illustrate more than a few of the possible design combinations within each of the basic shapes would be impracticable. Perhaps a few imaginary examples of right and wrong will point the way. A nameplate for a refrigerator is shown in *Fig.* 3. The simplicity of the circle harmonizes with the soft sweeps of the cabinet top and the door. The design at the left is satin-finish chrome with a light gray-blue enamel background. Three colors are used in the other: Red, blue and yellow. It is crowded, illegible, inappropriate and expensive.

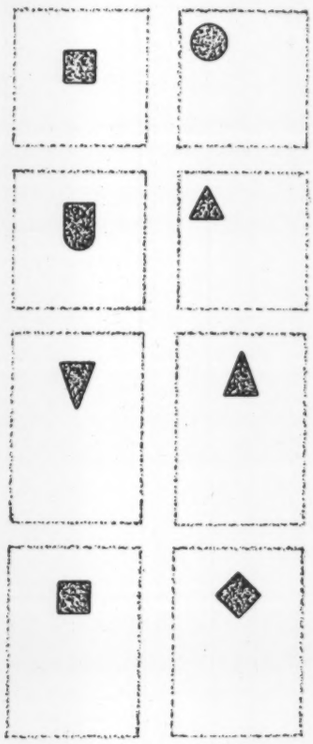


Fig. 7

Vertical lettering should be avoided because it is difficult to read. In certain cases, however, where all letters are "center-balanced" (like *H, M, O,* and *V*), and the word is short, it might be used if the composition demands a vertical type of plate as in *Fig.* 4. Both are treatments of the same shape and, although obviously bad, the one at the right is no worse than plates which are being registered regularly.

Long established concerns are often saddled with trademarks and logotypes which the management feels have become so intimately associated with their machines that they cannot be abandoned. In most cases there is no good reason not to change. Better lettering style and greater legibility would more than offset the "identification value" the manufacturer has established.

DERIVATIVE SHAPES: Suns, plant forms, hearts, stars, diamonds and other nature-derived shapes should be used as outlines for nameplates only with discretion. Sometimes, however, these shapes have become so closely associated with a manufacturer that, regardless of design difficulties, they must be kept at all costs.

LETTERING: Freak letter styles as well as underlining a script word with a swirl from the tail of a *Y*

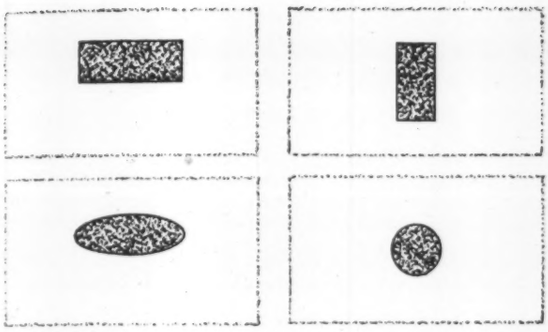


Fig. 8

or a *G*, should be avoided. If identification is to be less conspicuous but yet visible, there are various devices to employ. Lettering can be coined or embossed into a molding as shown in *Fig.* 5 (top). Or a separate plate in the form of a narrow band can be placed in such manner as to look as if it were an extension of, and continuous with, painted or stenciled stripes, *Fig.* 5 (bottom).

When the spaces between letters are increased to a point beyond easy legibility, each letter then becomes a small design element, or spot, in itself. This provides a clue if immediate identification is to be reduced to the minimum, yet have the legend actually present so that it can be read if searched for, *Fig.* 6.

Plate Shapes Should Harmonize

The infinite variety of square and rectangular surfaces in modern design makes illustration of suitable nameplate shapes difficult without using hundreds of examples. *Fig.* 7 shows eight squares and vertical rectangles arranged in columns; good treatments are in the left column, bad treatments in the right. Beginning at the top, the square nameplate harmonizes well with the square surface, but note that it is placed slightly above center. A circle (right) would be permissible but in this case it is poorly placed.

Next below, the plate with the rounded bottom goes well with the square, but the triangle is both out of harmony and badly placed. Third row, the elongated triangle placed on a vertical rectangle and pointing downward is logical; a similar triangle pointing up is contradictory to the form to which it is applied. The square plate at lower left would be permissible, but when turned 45 degrees, making a diamond, it appears "restless." In all of these examples the size of the nameplate has been exaggerated for purposes of reproduction.

If the main rectangle were horizontal, *Fig.* 8, a smaller rectangle or an ellipse (left) would be satisfactory, placed somewhat above center. The vertical rectangle at upper right is definitely inharmonious, and the circle, centered, is lost. The cylinder remains. *Fig.* 9 shows two good treatments on the left—a circle and an encircling band. The narrow rectangle and the triangle shown at right are both unrelated to the cylinder.

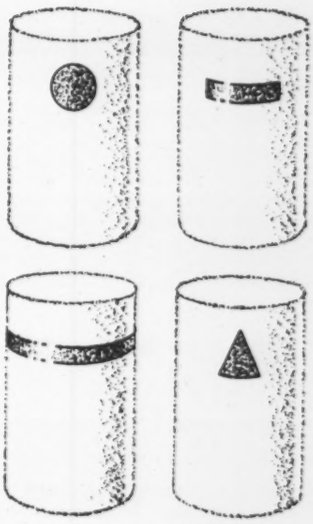


Fig. 9

Manufacturers are beginning to realize that they cannot teli their whole story in one place and still have it legible. Now, as a rule, factual data is relegated to a separate plate or transfer and placed where it offers no competition to the name plate proper.

Whether the data plate is prominently exposed, or placed at the back where it is inconspicuous, it should be designed as attractively as possible. In commercial and capital goods, blank spaces for future patent numbers provide a tough problem in themselves. These blank spaces are difficult to arrange properly because their visual weight is greater than the weight of the lettering itself. They should be manipulated so that they make a definite pattern.

Operating accessories include gages, thermal indicators, control panels, timing devices, and many other items. Principles governing their design are similar to those affecting nameplates, i.e., the material contained within the device must be harmonious with its own outline, and the outline of the device must harmonize with machine on which it is mounted.

In *Fig.* 10, buttons for starting, stopping, reversing, etc., have been arranged in a vertical panel

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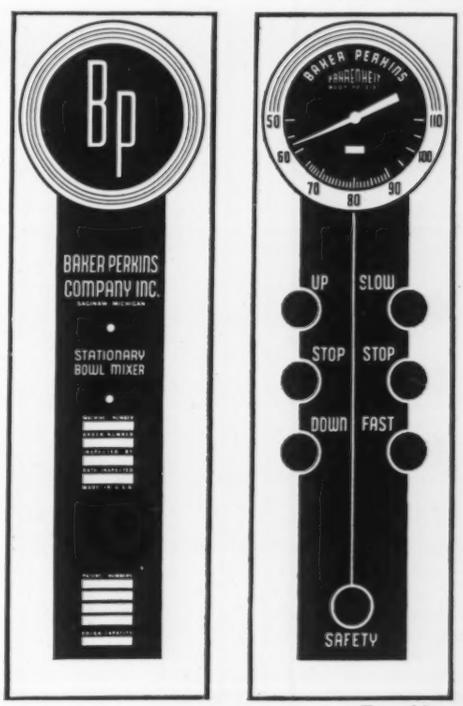


Fig. 10

Utilizing the F

Accurate M

By A. M. Wahl

Westinghouse Electric & Mfg. Co.

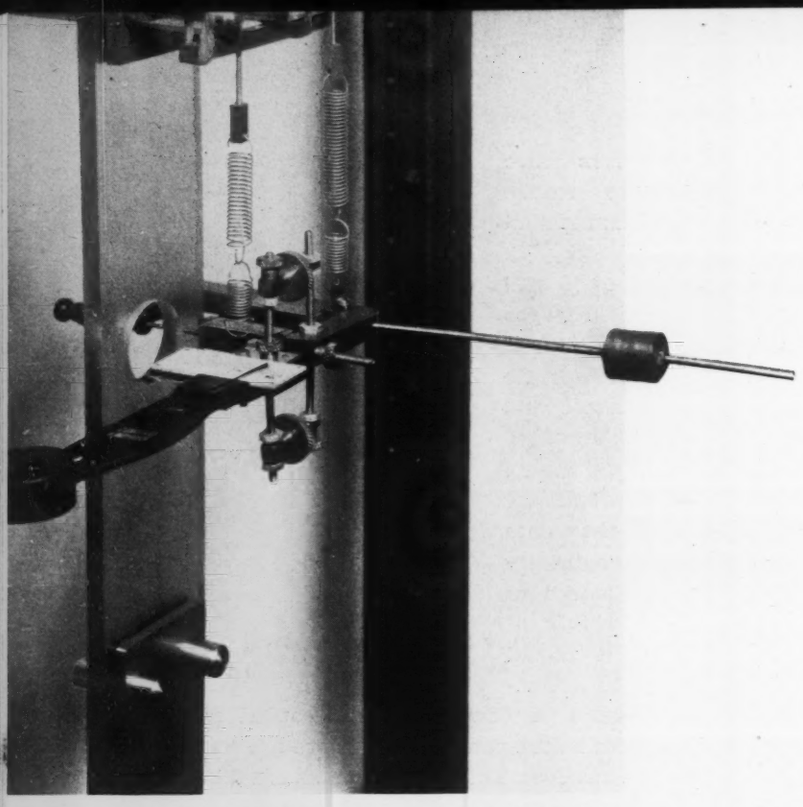


Fig. 1—Flat springs provide straight line motion and exert definite pressure on contact points of lateral extensometer

INDICATIVE of the versatility of flat springs are some unusual applications to two recently designed extensometers. Both utilize flat strips of spring steel to serve the dual purpose of guides to obtain a straight line motion and as a means of exerting a definite pressure on contact points. Flat springs also form an elastic pivot in one of the instruments, obviating knife edges.

Both instruments, one a lateral extensometer and the other a short-gage-length extensometer, will be discussed with respect to the design of their mechanisms and springs. The lateral extensometer is shown in *Fig.* 1 in position on a Bakelite test specimen. Minute lateral contractions in the thickness of the specimen are measured when load is applied. (These are of the order of .001 inch total; to obtain say 1 per cent accuracy it is necessary to measure these movements to .00001 inch.) These lateral contractions are directly proportional to the sum of the principal stresses[1] at any point in a flat specimen under load.

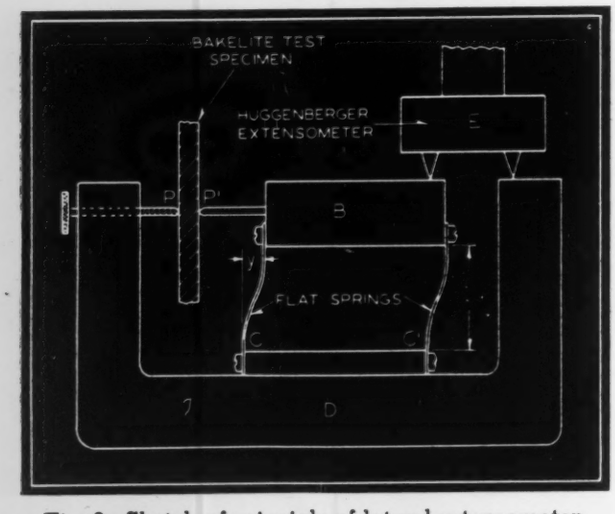


Fig. 2—Sketch of principle of lateral extensometer

A sketch showing the principle of this lateral extensometer is shown in *Fig.* 2. Points P and P′ are rounded for light contact against the test specimen. Flat springs C and C′ exert a pressure sufficient to hold the points at a definite location on the test piece. The whole assembly is supported by the helical springs shown in *Fig.* 1, a static balance of the instrument being effected by means of the weights shown. Because of the considerable flexibility of the supporting helical springs slight movements or distortions of the test specimen may occur without causing lateral slippage of the points *P* and *P′*, *Fig.* 2, resting on the specimen. Since a variation in thickness of only .00005 inch would be enough to introduce an appreciable error in the results, this elimination of sidewise slippage or movement during the specimen loading is important.

From *Fig.* 2 it may be seen that any lateral contraction of the test specimen will cause a relative motion of points *P* and *P′* which in turn results in a motion of the bar *B* with respect to the frame *D*. This motion is recorded on the Huggenberger extensometer *E*.

For calculating the flat springs *C* and *C′*, let P = pressure per spring on specimen, the total pressure on the points being $2P$, y = deflection of springs, *Fig.* 2, I = least moment of inertia of spring cross section E = modulus of elasticity of material, l = length of spring. Then (from beam theory):

$$P = \frac{12\,E\,I\,y}{l^3} \qquad (1)$$

The maximum stress S is given by

$$S = \frac{3\,y\,E\,h}{l^2} \qquad (2)$$

These equations are based on the assumption that

1. If a square element is imagined as cut out of a flat specimen under load and if this element is imagined to be rotated until no shearing stresses act on its sides, the two stresses acting on perpendicular planes are called principal stresses.

the Flat Spring in ate Mechanisms

the vertical load P_v on the spring C' *Fig.* 2, set up by the clamp holding the Huggenberger extensometer E against the bar B, is very small compared to the critical buckling load P_{cv} (where $P_{cv} = \pi^2 EI/l^2$) as given by Euler's column formula). This was true in the case under consideration.

Distribution of principal stress sums $(S_1 + S_2)$ along the longitudinal axis of a flat bar with a hole subjected to tension stress has been determined experimentally using the lateral extensometer as indicated in *Fig.* 1. The measured test results are shown by the full lines of Fig. 4. For comparison, a theoretical curve calculated from formulas developed by Howland[2] is given. Substantial agreement between test and theory is indicated.

Springs Form Elastic Pivot

Design principle of the short-gage-length extensometer is shown in *Fig.* 6. A short gage length is necessary because at points of stress concentration the stresses change rapidly; hence to obtain the peak stress it is necessary to measure strains over a very short length compared to the size of the discontinuity (hole, fillet, etc.). Essentially the instrument is comprised of two light hollow tubes attached to two knife edges B and B'. These knife edges are held together by the spring steel strips S, *Fig.* 6*a* which are essentially flat springs. Points of the extensometer press against the specimen by means of a special clamp shown in *Fig.* 5.

When deformation of the specimen occurs, Point B' in *Fig.* 6*a* moves to, say, B''. This causes rotation of the movable lever arm T as indicated by the dotted lines, with resulting deformation of the spring steel strips. The result is that the whole assembly pivots about the point O, and because of the length of the lever arms a considerable magnification takes place.

Referring to *Fig.* 6*b* any relative motion of points B and B' is thus communicative to the targets A after being magnified by the lever ratio.

In designing the spring steel strips S it was necessary to make them stiff enough so that buckling due to the clamping load P would not occur, while at the same time permitting sufficient flexibility so that no appreciable restraint to the deformation of the specimen would be imposed. By using spring steel strips in this way, the use of additional knife edges with their attendant disadvantages was avoided.

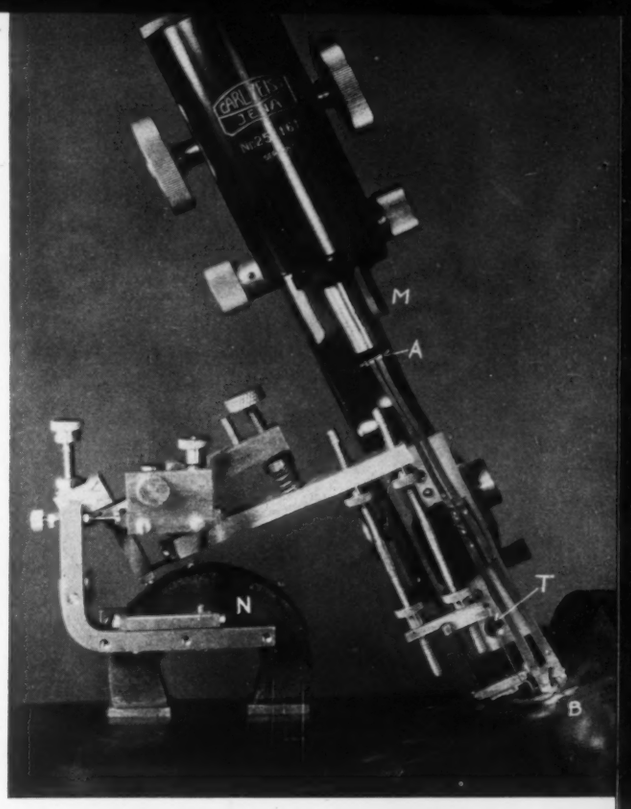


Fig. 3—Short-gage-length extensometer utilizes flat springs for pivot and also for straight line motion and definite pressure

Further application of flat springs is shown in the special clamp used for holding the extensometer points against the test specimen. This special clamp is shown schematically in *Fig.* 5. A magnet holds the whole assembly firmly against the test specimen. Flat springs D and D' allow a horizontal motion of the clamp when the screw E is turned. By this means the point P may be located accurately. Compressing the helical spring S a given amount applies a definite load.

Lateral adjustment of the clamping point P (not

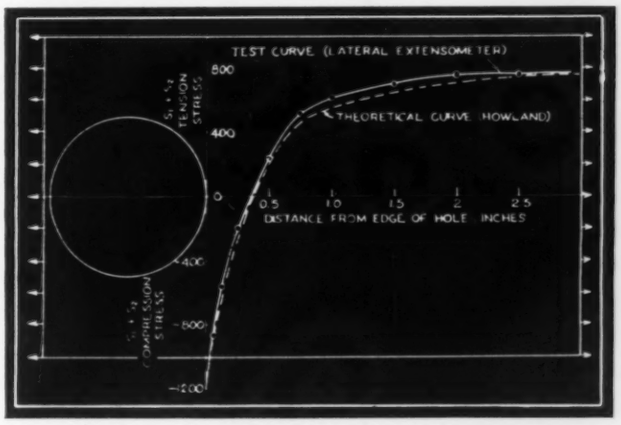


Fig. 4—Theoretical stress distribution along axis compared with test results as measured by lateral extensometer on flat bar with hole under tension

2. *On the Stresses in the Neighborhood of a Circular Hole in a Strip in Tension* by R. C. J. Howland, Phil. Trans. Royal Society of London, A 229, 1929, p. 49.

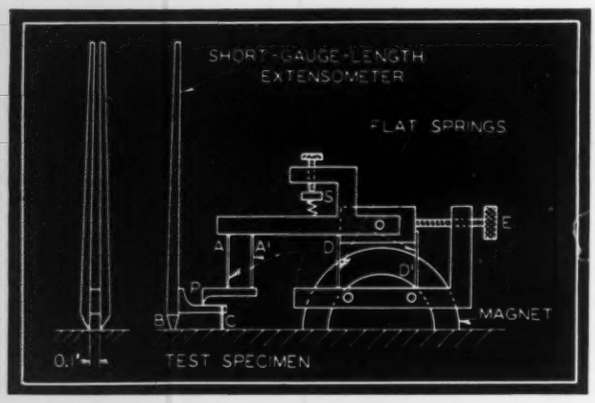


Fig. 5—Scheme of clamping arrangement for short-gage-length extensometer

shown in *Fig.* 5) is also provided. The strip A' is essentially a flat spring while A is a thin round bar. The purpose of this arrangement is to allow slight movements of the extensometer relative to the clamp, caused by distortion of the test specimen, to take place both laterally and longitudinally without resulting in lateral forces which may cause distortion in the instrument or slippage of the gage points. Either of these latter effects would produce errors in the results.

Flexible strip C provides a three-point support for the clamping load P, while at the same time slight distortions of the specimen between points B and C may be taken up by deflection of the strip without imposing appreciable lateral load on the points. In designing these flat springs it was necessary to guard against buckling under the action of the clamping force.

The importance of eliminating errors due to these causes may be realized if it is considered that in order to measure strain on a .1 inch gage length for ordinary carbon steel it is necessary to measure to within 2 millionths of an inch to obtain 2 per cent accuracy, since the total elongation in the gage length is only about one ten-thousandth of an inch at the elastic limit. Tests on this instrument showed that it could be removed and reclamped to a steel test specimen several times with a maximum deviation of 1½ per cent from the mean value of the readings.

In *Fig.* 3 the extensometer is shown in position on a shaft fillet. The microscope M, the targets A, the flexible strips T, the points B, and the magnet N are indicated. The relatively short gage length compared to fillet size is apparent from the picture.

A comparison between the photoelastic test results

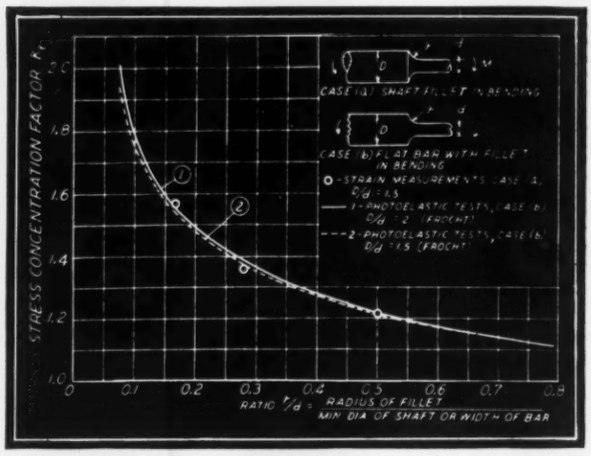


Fig. 7—Comparison of stress concentration factors for fillets found photoelastically and by extensometer

obtained on flat bakelite models of shaft fillets by Frocht[3] and the results obtained by means of the short gage length spring type of extensometer on actual steel shafts with fillets is indicated in *Fig.* 7. The curves represent stress concentration factors (i.e. ratios between peak stress and nominal stress, the latter being equal to the bending moment divided by the section modulus) plotted against ratios r/d between fillet radius and small shaft diameter. The full and dotted lines represent cases where the ratio $D/d =$ 2 and 1.5 respectively, D being the large shaft diameter. The values obtained by using the extensometer are shown by the circles. It may be seen that the results obtained by these strain measurements are in good agreement with the photoelastic test values.

Thus it may be seen that the design of both the lateral and short gage length extensometers has been considerably facilitated by the use of flat and helical springs in various forms and that their utilization has contributed toward the accuracy necessary to respond to small deformations in fillets, transverse holes and press fits.

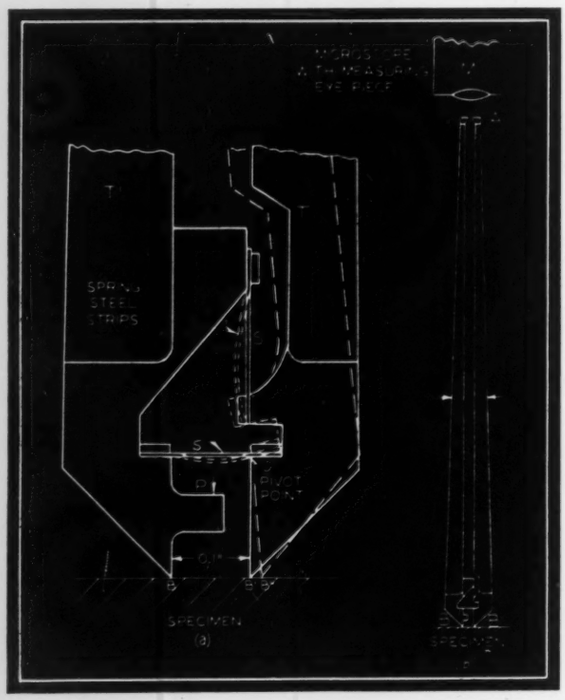


Fig. 6—Detail of points showing mode of deformation on short-gage-length extensometer

3. *Factors of Stress Concentration Photoelastically Determined* by M. M. Frocht, Journal of Applied Mechanics, June 1935.

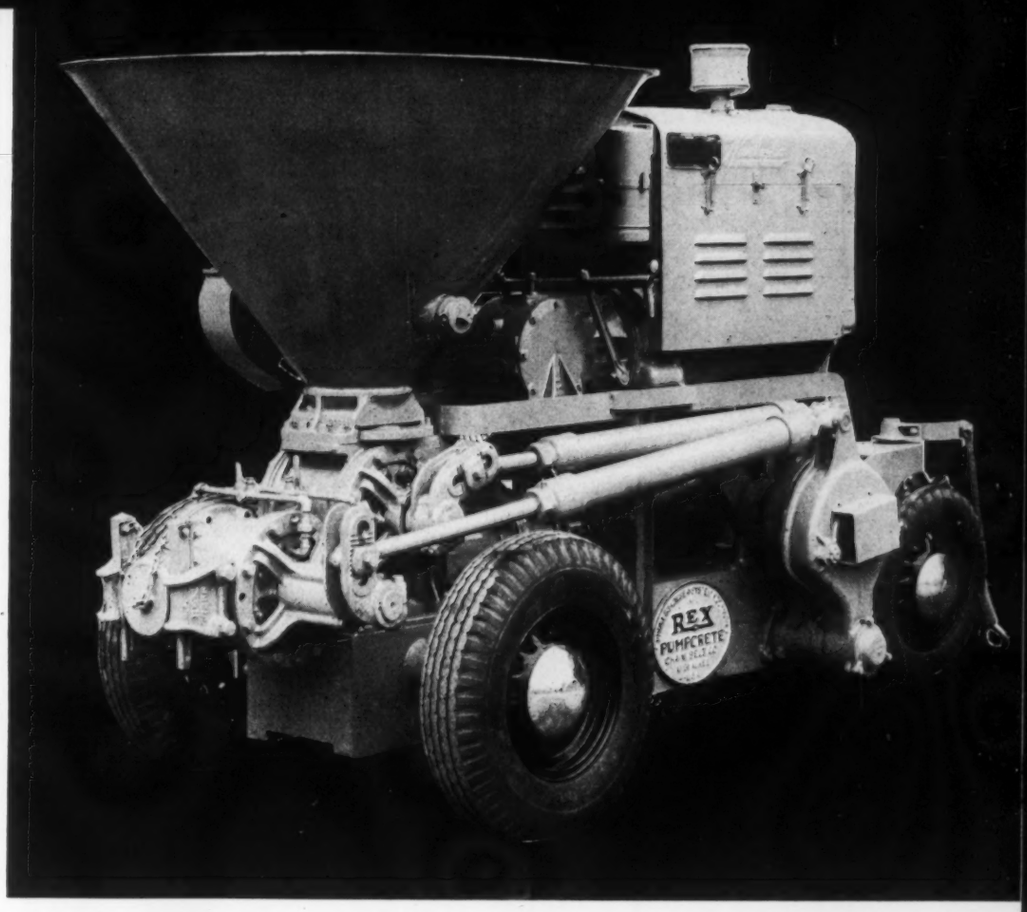


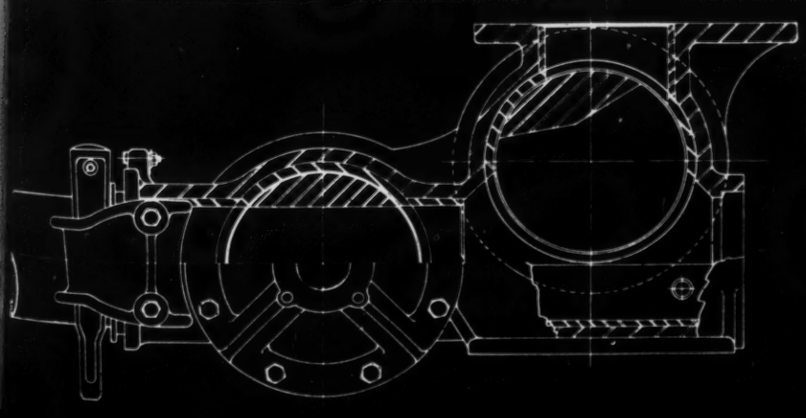
Fig. 1 — Right — Concrete pumping machine utilizes characteristics of concrete to advantage in design. Fig. 2 — Below — Drawings show design of valves. Stub shafts are journalled in sealed roller bearings

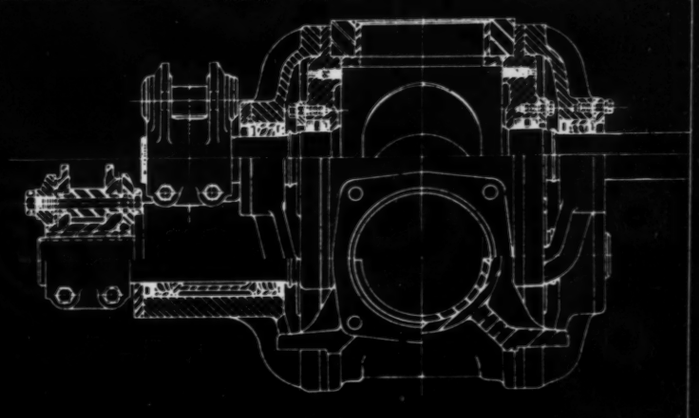
By C. F. Ball
Chief Engineer, Chain Belt Co.

Ordinarily Handicaps—But Capitalized in Design!

TO FORCE freshly mixed concrete through pipelines at construction jobs necessitates specially designed pumps because of the peculiar nature of the material. Concrete is semifluid only insofar as the mass as a whole is concerned being composed of solid pieces of various sizes with a liquid ratio of 10 or 15 to 1. Tendency to "bridge" or "log-jam" is so pronounced that it cannot be handled by ordinary methods. Also, because of sand content and sharp edges of aggregate pieces, it is highly abrasive.

These characteristics of concrete are responsible for the unusual design of the pump shown in *Fig.* 1 employing nearly conventional crankshaft, connecting rod, piston and cylinder. The valves, however, are modified plug cocks which operate in timed relation with the movements of the piston. Because the nature of the material resists changes of any kind, the inlet and outlet valve ports are nearly as line is of similar size. No sharp corners or sudden large in diameter as the cylinder. Likewise the pipe-





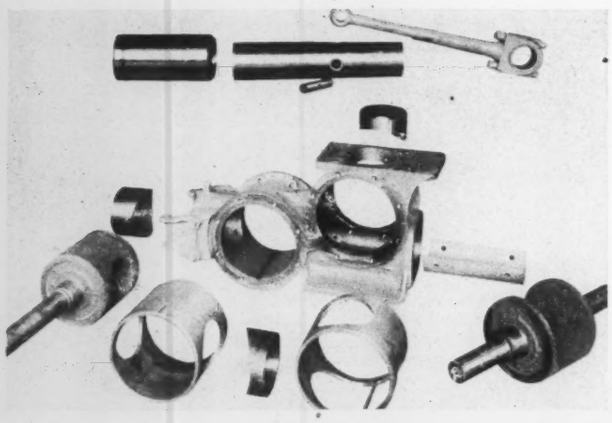
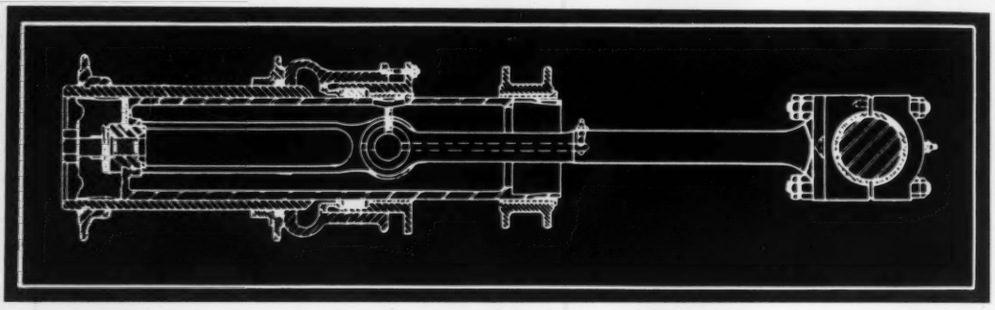


Fig. 3—Above—Parts of valves and piston. Fig. 4—Right—Drawing of piston with stuffing box and bridle



changes of direction are possible at any point either in the pump or line.

Tendency to "bridge" or "log-jam" in case there is a sudden reduction in the size of the passage through which concrete is forced, or in case of a sudden change of direction, is employed to advantage in the design of the valves. Instead of closing fully they close only partially as the concrete itself "stows" at the restriction, completing the closure. This obviates the necessity of the valves acting as rock crushers or stone cutters and consequently the worst cause of wear or possible breakage is eliminated.

Pressures Reach 750 Pounds

Working pressures, depending on the length of the pipeline, difference in elevation to the delivery point and the composition and stiffness or dryness of the concrete handled, may run as high as 400 pounds per square inch for each working stroke. In case of complete stoppage of the line the stalling pressures may be as much as 750 pounds per square inch. All of the pump parts therefore are designed for these pressures.

Either single or double-cylinder pumps are used. A double-cylinder pump has one right-hand unit and the other left-hand, mounted on a welded steel frame. Each has an independent crankshaft, driving gear and valve operating mechanism. A common countershaft drives the two crankshafts in proper synchronism 180 degrees apart.

Single pumps are also built into welded steel frames. On the larger sizes a semisteel bed casting incorporates the crankshaft bearings and cylinder assembly. Valve chambers are cast steel, bolted to the bed casting and to the steel frame. For the smallest size, crankshaft pillow blocks, piston skirt guide, cylinder support and valve chamber are all bolted to the welded frame. All frames have welded-on pads, finished to a single plane or level.

Crankshafts, depending on size of machine, are hammer forged or drop forged SAE 1045, heat treated before machining and are mounted on antifriction bearings. Cut tooth driven gears are SAE 1045 steel castings, heat treated before machining. Drive pinions are case hardened alloy steel. The drive from the motor or internal combustion engine to the pinion or countershaft is V-belt. The large pulley which acts as a flywheel, has a shear pin drive connection to the hub.

Does Not Contact Concrete

Piston and cylinder arrangement is unusual, the piston proper not coming in contact with the cylinder wall. Instead, a rubber piston end of the type developed for oil field mud pumps fits tightly in the cylinder liner and does the actual work of pushing the concrete. The piston, see *Figs.* 3 and 4, is carried in a bronze-bushed stuffing box or gland, and a bridle or piston skirt guide located approximately 10 inches away toward the crankshaft. The gland seals the space around the piston. This space is filled with constantly changing wash water to rinse off any solid material that works past the rubber.

Replaceable cylinder liners are used. Both heat treated alloy steel and centrifugally cast chrome iron, heat treated to more than 500 brinell give satisfactory results. Best results, however, have been obtained with a special patented material fused to the inside of seamless steel tubes which has a brinell of more than 800. One of these liners has a record of more than 50,000 cubic yards for a single cylinder. The bores of all liners are ground to a smooth finish.

As previously mentioned, the valve ports are nearly as large or in some cases larger than the cylinder bore. *Fig.* 2 shows how stub shafts project from each side of the plug and are journalled in roller bearings. These bearings are located in squirrel cage extensions from the valve chamber, and are entire-

ly out of contact with concrete. Glands are used at the points where the stub shafts project through the sides of the valve chamber, and additional packing is used at the plug rim, one on each side. The spaces between the rim packing and the glands are filled with special grease under pressure. This seals the concrete from escape past the ends of the plug.

Both plugs are of large diameter, 10 to 12 inches. The outlet plug is pierced by a hole the same diameter as the ports. The inlet valve plug is segmental with an opening of the same diameter as for the outlet valve, but U-shaped and open on one side. There is a radial clearance between the plug and chamber of 1/32 to 1/16-inch when new. This space is increased by wear to as much as ⅜ to ½-inch before it is necessary to make replacements. On the larger machines a replaceable mantle is used on the outlet plug.

Replaceable liners are used in the valve chamber around the plugs on all the machines. The plugs are steel castings of approximately SAE 6145 analysis, and are heat treated to 425 brinell. Replaceable liners are alloy plate stock stamped to form half circles and welded into a complete ring. The rings are then heat treated and ground on the outside diameter. Valve chambers are steel castings, all internal surfaces that come in contact with concrete being lined with replaceable liners or hard surfaced. Assembly parts are shown in *Fig.* 3.

Spring Relief Rods Operate Valves

Operating mechanism for the valve is interesting. When certain harsh and unworkable mixtures are pumped, it may require one-quarter to one-half as much power to operate the valves as to drive the piston. "Stuck" valves may stall a 50-horsepower motor which gives some idea of the strength of the operating mechanism required.

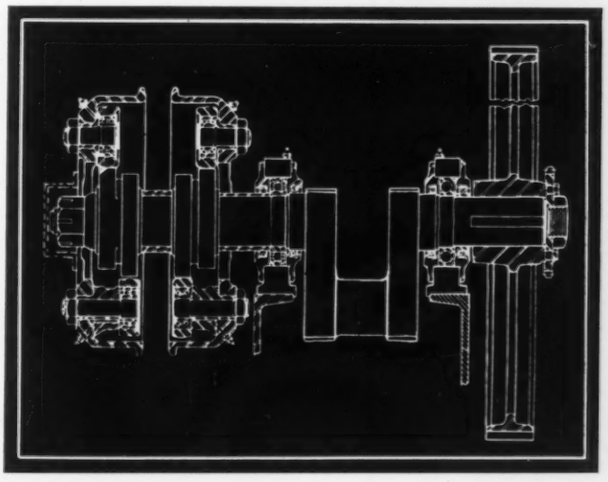
Large, machined, case-hardened cams mounted on the crankshaft provide the operating force, as shown in *Fig.* 6. Needle bearing cam rollers of SAE 4615 case-hardened steel are supported in cast steel "banjos" that oscillate on antifriction bearings. Spring relief valve rods connect the banjos to the valve plug levers. The outlet rod has a single spring preloaded to about 2000 pounds. The inlet rod has double-acting relief springs, each preloaded to more than 1700 pounds. These rods are illustrated in *Fig.* 5. As mentioned earlier, the valves do not close completely. However, a larger than usual piece of aggregate may be caught in a valve, and in this case the release spring comes into operation. Very harsh mixes may also cause some sticking of the valves, and the relief springs become effective.

All size units have 12-inch stroke. Cylinder diameters are 5-5/16 inches, 7-3/32 inches and 7⅞ inches. Operating speed is 50 revolutions per minute. Capacities of the single-cylinder units vary from 20 to 35 cubic yards per hour, and for the double, from 40 to 70. Power requirement for the single-cylinder pump is from 25 to 40 horsepower, depending on the size, and for the duplex pumps, 40 to 50 horsepower, electric, or 45 to 60 horsepower, gas engine.

A small revolving agitator shaft located in the bottom or a trough-shaped pugmill remixer keeps the concrete continuously agitated until it is sucked into the cylinder through the inlet valve.

Ordinarily a single pipeline is used with a duplex pump. A removable Siamese section which is really part of the pipeline connects the two cylinders and merges the two streams of concrete. At the junction point the cross sectional area of the passageway is about 50 per cent larger than the pipeline in size. A taper section 5 feet or longer gradually reduces this section to that of the pipeline.

As may be seen in the design of this pump, characteristics of a material which ordinarily would present handicaps or prove detrimental have been capitalized upon to effect an efficient, rugged machine.



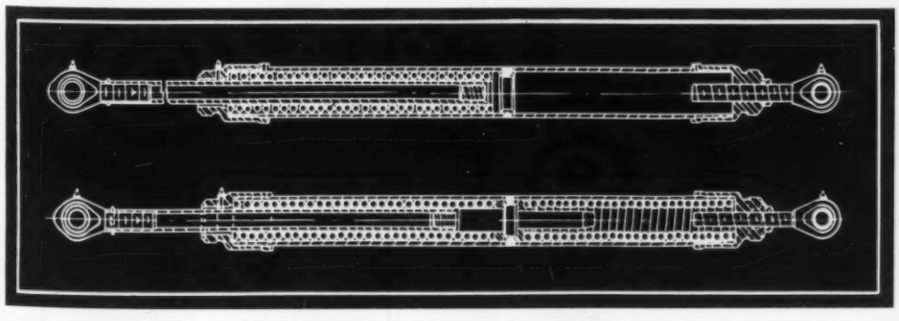


Fig. 5—Left—Outlet and inlet rods showing single and double acting springs. Fig. 6—Above—Case hardened cams provide operating force

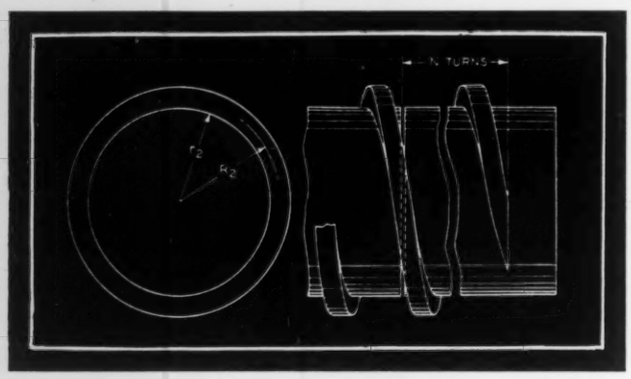


Fig. 1—Diagram of spring clutch showing spring turns on driving drum and arbor

By C. F. Wiebusch
Bell Telephone Laboratories Inc.

Capacity of Spring Clutches*

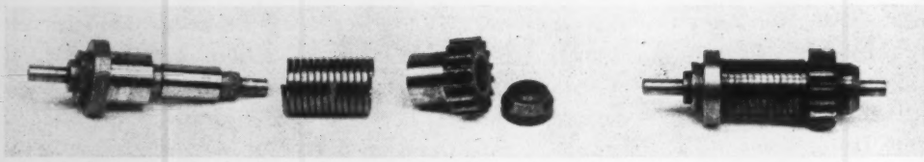


Fig. 2—Telephone-dial clutch with parts disassembled and also assembled

SPRING clutches of the type employed extensively on telephone-dial governors have widespread uses. In this particular application the clutch permits the dial to be wound without dragging the governor and to couple the governor to the system with a negligible backlash for motion in the pulsing direction.

Such clutches consist of two cylinders placed end to end, rotating on a common axis and torsionally coupled by the friction between the cylinders and a coil spring fitted over the cylinders. Their design from relations derived from the requirements of the application and the constants of the spring material can be reduced to a simple routine. Parts for one of these clutches and also an assembled clutch are shown in *Fig.* 2.

If the driving drum is rotated in the direction to wind the spring and decrease the diameter, the spring will grip the cylinder and will be capable of exerting much more torque than it would in the direction of rotation which tends to unwind the spring. In *Fig.* 1 assume that the spring is fastened to the left-hand portion of the arbor in order that any slipping which may take place must occur on the driving drum on the right. Assume also that the spring is so formed that the inward radial force on the drum per unit length of the material is constant when no torque is applied.

As compression exists in the spring wire at any point when the arbor is turned to make the spring unwind, there will be a radial force subtracting from the radial force when no torque is applied. Due to the increase of compression in the wire along the length of the line of contact due to friction, the torque in the free direction becomes

$$T = r_2^2 f_0 \left(1 - e^{-2\pi N\mu}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

If $N\mu$ is greater than one the exponential term be-

(*Concluded on Page* 60)

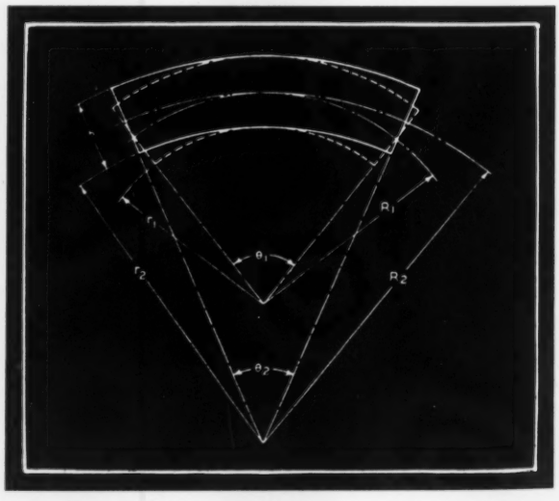
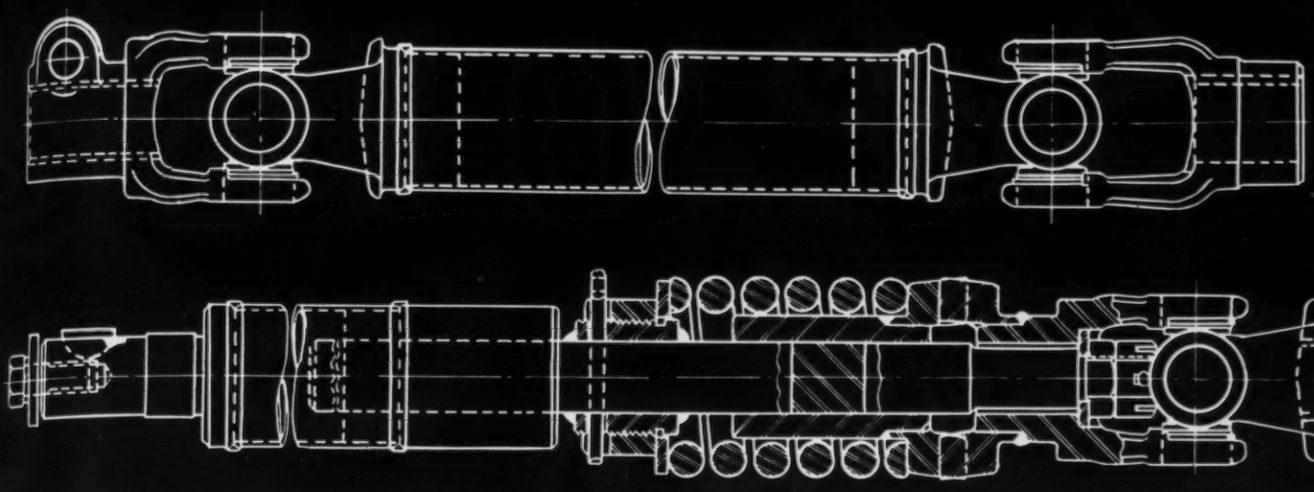


Fig. 3—Element in initial and expanded condition

*From a paper presented at the National Meeting of the Applied Mechanics division of the American Society of Mechanical Engineers.



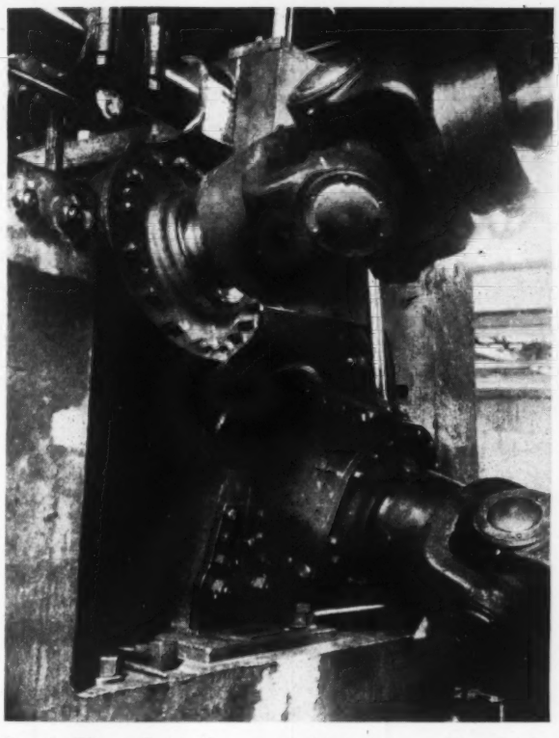


Fig. 1—Top—A triple universal joint assembly which operates at angles up to 45 degrees. Note slip joint of square shaft in square hole in plug at end of tube. Fig. 2—Above—Massive universal joints which operate slowly but take angles up to 25 degrees

Points To Consider in Applying Universal Joints

FOR correcting angular or parallel misalignment . . . . . for increasing the life of other drive parts such as gears and bearings . . . . . for saving time during assembling and disassembling . . . . . for many power transmission problems where other means would be well-nigh impossible . . . . . universal joints afford a positive, flexible drive, vertical or horizontal. Customarily they can be used at angles up to 20 or 25 degrees, although certain types are satisfactory at angles up to 45 degrees. For a pair of joints, 90 degrees angulation may thus be obtained. Some joints are said to have an efficiency of over 99 per cent at angles up to 15 degrees. The type of joint in *Fig.* 3 will operate at a maximum angle of 37 degrees, for instance, but under heavy loads 15 degrees is the safe limit. The particular machine in which the joints are used in the instance illustrated is a multiple boring machine with a capacity for boring 10 holes at once.

A maximum speed of 4000 revolutions per minute is usually given for universal joints, but there have been cases where this figure was increased to 8000 revolutions by careful dynamic balancing of each end of a shaft independently. An example at the other end of the scale, i.e. slow speed, is shown in *Fig.* 2, where massive joints are used on an automatic bar straightening machine to straighten alloy steel bars up to diameters of 8½ inches. Joints of this size and weight vary in speed from about 50 to 200 revolutions per minute and transmit from 10 to 250 horsepower. But even these large joints operate at angles of from 12 to 25 degrees.

Tubular shafting, because it weighs less and permits use of a slip joint to compensate for end movement, thus enhancing the safety factor, is usually recommended for the shaft to which universal joints are attached when speeds are high and shafts are long. Solid shafts are specified when shafts are relatively short or operate at low speeds. If possible, when

solid shafting is used or when a shaft is so short a slip joint cannot be used, a slip should be taken on one of the fitting yokes to allow for variation.

Speeds at which shafts may be safely driven through universal joints depend in part on the critical speeds for shafting of various diameters and lengths. For instance, the formula for the critical speed of tubular shafting is

$$R.P.M. = \frac{4{,}705{,}000}{L^2}\sqrt{D^2 + d^2}$$

For solid shafting, the critical speed formula is

$$R.P.M. = \frac{4{,}705{,}000}{L^2}\ D$$

In these formulae, L is the length in inches, D is the outside diameter of the tube in inches and d is the inside diameter of the tube in inches.

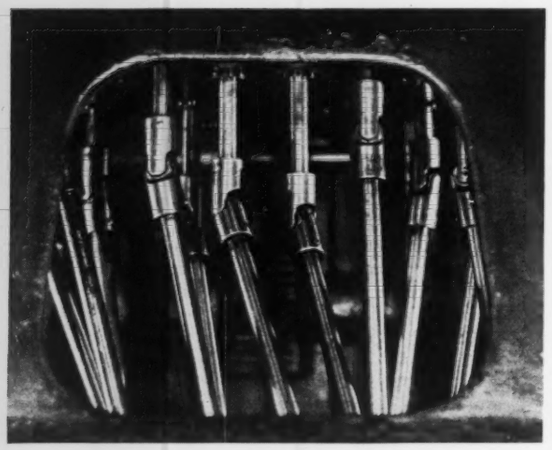


Fig. 3—Application of universal joints to multiple boring machine. This type of joint will operate at maximum angle of 37 degrees

In actual use, of course, critical speeds of shafts are valuable mainly because they indicate a maximum which can be approached only part way if universal joint shafting is to operate safely. As a rule, for speeds less than 2000 revolutions per minute and lengths less than 72 inches, tubular shafting may be specified with a safety margin of 15 per cent from the critical speed. Higher speeds and longer lengths demand a safety factor up to 25 per cent. Solid shafts should be used at speeds at least 20 per cent below the critical speed.

When considering the safety factor, moreover, the designer should remember that many other elements enter the picture, such as the angle of operation, shock loads, balance, lubrication, and continuous or intermittent service.

Varying angular velocity of the shaft between universal joints is one of the principal bugaboos connected with them. Universal joints are most commonly used in pairs and, under ideal conditions, it is possible to insure uniform angular velocity when working angles in both joints are equal and when joint trunnions are in the same plane. If for any reason this condition does not exist, it can be counteracted best and a smooth running assembly obtained if the shaft weight is kept as low as possible. When only one joint is used in an assembly, the total fluctuations in angular velocity are proportionate to twice the cosine of the working angle. Because the center lines of the two shafts connected must intersect in the exact center of the joint, a single universal joint is limited in application. It will, moreover, take only angular misalignment.

To meet such a situation and to provide for both angular and parallel misalignment, a double universal joint is sometimes employed, consisting of a pair of joints with a short shaft between them. This kind of joint does not take care of end float or movement endwise of the shafts, however. If this problem exists, one of the universal joint yokes should be mounted on the shaft with a sliding fit spline and should have a grease fitting to lubricate the spline.

Slip Joint May Be Square

At lower speeds the slip joint may be made with a cold rolled square shaft operating in a broached square hole in a plug in the end of the tube, as illustrated in *Fig.* 1. This triple joint assembly, used primarily for power take-off drives between tractors and other farm machines, illustrates a universal joint which operates satisfactorily at angles up to 45 degrees in a single joint, or 90 degrees in a pair.

The secondary loads imposed on shafts to which universal joints are attached comprise a problem frequently overlooked. But they are very important because they not only impose bending stresses in the shafts but at higher speeds may impose severe loads on the shaft bearings. The secondary loads imposed upon the driving and driven yokes, of course, depend on the angles of misalignment and the angles of revolution. When the plane of the yoke is in the plane of the shafts the secondary load is zero; when the yoke is at 90 degrees to the plane of the shafts, it is maximum. It has been found, therefore, that when A is the angle at which shafts are out of line and a is the angle of revolution, the secondary couple imposed upon the *driving* yoke (which must be absorbed as a bending moment in the shaft and as a bearing load) equals the torque input times the tangent of A times the sine of a. The secondary couple imposed on the *driven* yoke equals the torque input times the sine of A times the sine of a.

For their co-operation in supplying information and illustrations for this article, the editors wish to thank Mechanics Universal Joint division (*Fig.* 1, data on secondary loads); The Almetal Universal Joint Co.; Boston Gear Works (*Fig.* 3); The Medart Co. (*Fig.* 2).

How Hardening and Temperature Affect Steel

EFFECTS of hardness and ambient temperatures upon strength, ductility and toughness should be known when applying hardened steels to machine parts requiring resistance to impact and battering wear. Interesting are the results of tests to determine these effects made by S. W. Lyon at the University of Illinois and reported in a paper at the recent meeting of the American Society for Metals. His work shows that for the heat treated carbon steel tested, properties are improved at increased hardness. Beyond a critical hardness, however, radical losses in strength, toughness and ductility were observed. Temperature changes within the range of 70 to —70 degrees Fahr. produced little change in properties although the as-rolled steel was more affected than heat treated specimens.

Steel with an analysis of .73 carbon, .88 manganese, .14 silicon, .012 phosphorus, .022 per cent sulphur was used. Test specimens were heat treated by quenching to obtain maximum hardness, followed by drawing to obtain the desired final hardness. The procedure was: Heat to 1400 degrees Fahr., hold 30 minutes, quench in oil, draw for one hour at temperature necessary to produce the required hardness.

Examination of the curves in *Fig.* 1 shows that maximum values of tensile strength were obtained at the hardness of approximately rockwell C-52 and that for hardnesses in excess of this value the tensile strength values fell off rapidly. These test results seem to indicate that from the standpoint of tensile strength the usable hardness for this steel is exceeded when a value is obtained higher than approximately rockwell C-52. Values for reduction of area also fell off rapidly when this hardness was exceeded, while elongation values decreased more gradually.

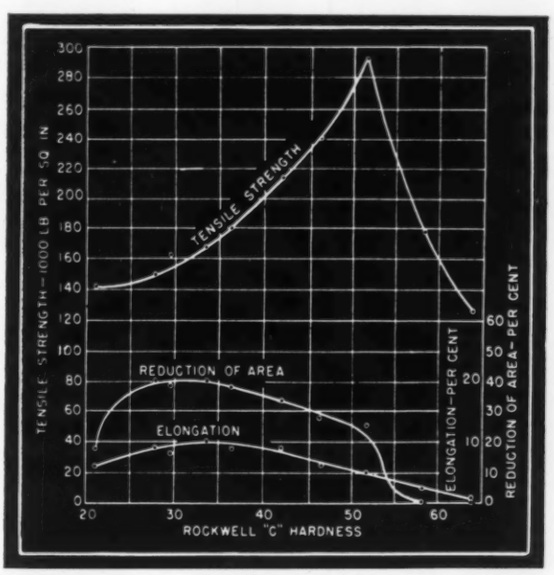


Fig. 1—Tensile strength, reduction in area and elongation of specimens plotted against hardness

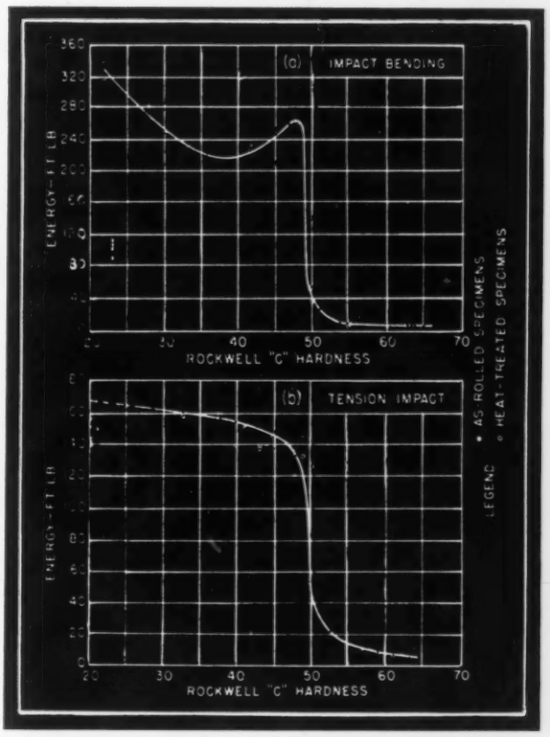


Fig. 2—Impact test results shown with respect to hardness. Top (a) are results of impact bending while bottom (b) are those for tension-impact

Toughness Drops Radically

Results of impact-bending and impact-tension tests of unnotched specimens of varying hardness are given in *Fig.* 2. Considering these results as criterion of toughness it can be observed that the toughness of this heat treated steel drops off rapidly when the hardness of C-48 is exceeded. Further examination of the curves shows that the plotted test results from some specimens of similar hardness, i.e. C-48, group themselves on the upper and lower levels of the impact strength curves. This indicates that there is a very abrupt transition change in the property of the

material to resist impact loads. The abrupt change of impact strength is apparently accompanied by some instability as evidenced by the spread of impact strength for specimens of similar hardness in these tests.

To determine the variation of toughness of the steel with change of temperature, the energy developed in impact-bending tests was considered as the criterion of toughness. Variation of toughness with change of

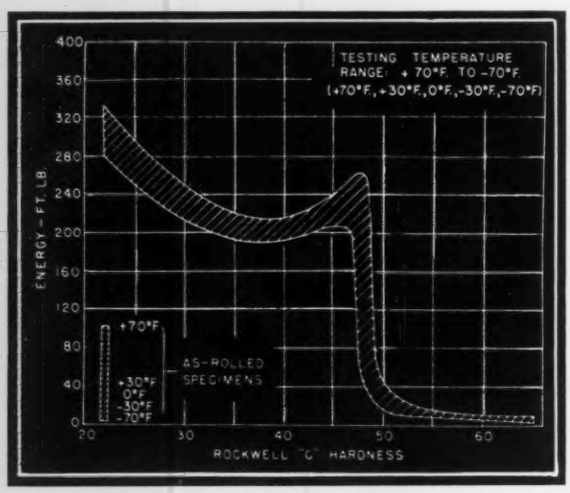


Fig. 3—Envelope of variations of hardness against impact strength caused by testing temperatures

temperature was obtained by determining the impact-bending results versus rockwell hardness relationships for five testing temperatures. The method used to cool the specimens for testing at the various lowered temperatures employed an insulated container filled with acetone and cooled with dry ice. It was possible to hold temperatures to within one degree. Testing required only 3 seconds and for this time interval no temperature changes were discernible. Five testing temperatures, namely +70, +30, 0, —30, —70 degrees Fahr., were used to determine hardness relationships.

Properties Change Only Slightly

Hardness versus Charpy impact strength relationships are shown in *Fig.* 3 as obtained for five testing temperatures between 70 and —70 degrees Fahr. Values obtained for the as-rolled specimens are included and appear in the lower left corner of the diagram. The envelope was constructed by superimposing the hardness versus impact relationship curves for the various testing temperatures and then enclosing all curves. For clearness the individual superimposed curves have been omitted and the resulting cross-hatched envelope gives the spread of average values of hardness versus Charpy impact strength obtained for the range of testing temperatures. The envelope has the characteristic form of the individual curves with a sharp drop in impact strength occurring at all temperatures when the hardness range of C-47 to C-50 is exceeded. These results indicate that the toughness of this heat treated steel is not greatly changed or affected by temperature.

As previously noted the impact-bending test results of the as-rolled specimens are given in the lower left corner of *Fig.* 3. The average value of impact strength of as-rolled steel falls from 100 foot-pounds at 70 degrees to less than 5 foot-pounds at —70 degrees. *Fig.* 4 presents these results in another form and in addition for comparison presents the results of the impact tests at the same hardness, C-22, as the as-rolled specimens. The heat treated specimens have a high impact resistance and over the range of testing temperatures lose but 15 per cent of their strength against 95 per cent for the as-rolled specimens.

Also, it should be noted that for equal hardness the heat treated pieces at 70 degrees Fahr. have an average energy value of 290 foot-pounds against 100 for the as-rolled pieces. These results indicate that the heat treatment of the steel tested produced two beneficial results, namely, the impact strength was

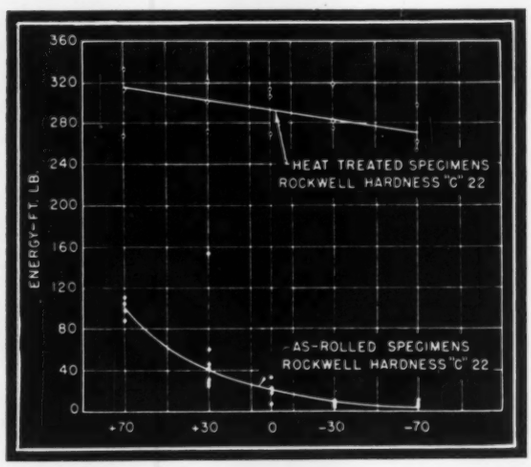


Fig. 4—Comparison of variation of impact strength of heat treated and as-rolled specimens

much improved over the as-rolled condition, and lowering of temperature had much less effect on the impact strength.

From the foregoing it is indicated that the usable hardness of heat treated steel is exceeded when the hardness goes above approximately C-47. Beyond that limit the material could not be used without considerable sacrifice of strength, ductility and toughness. If this heat treated material were used in a service application the lower limit of hardness would not be governed by toughness considerations. Rather, wear or strength considerations would be the criterions for fixing the lower limit of hardness of this carbon steel.

Economies Are Effected by Welding*

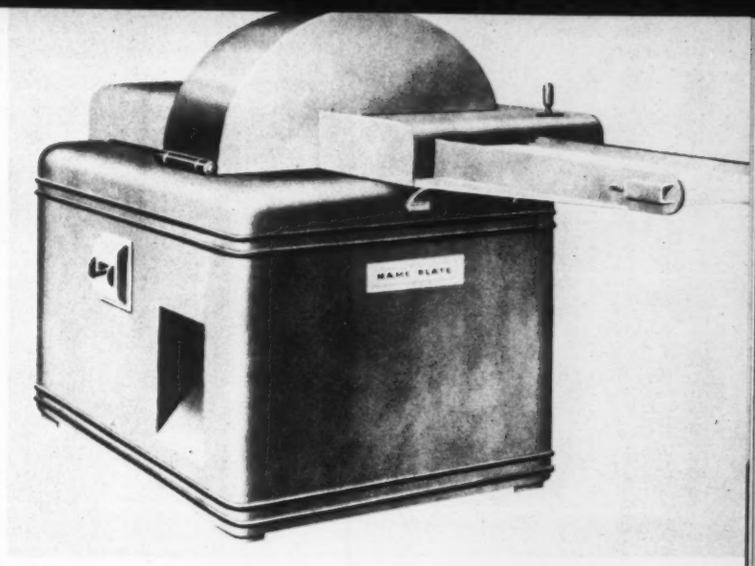


Fig. 1—Top—Redesigned paper shredding machine has clean lines. Fabricated by welding, bolts and nuts are concealed and many parts are combined to reduce number. Considerably lighter in weight than the previous model (Fig. 2—Above)—the improvements are readily apparent

IN DEVELOPING a new model of paper shredder, modern trends in design were followed. The resulting machine is shown in *Fig.* 1. All possible projections have been removed from the main part of the machine and those that could not be removed are enclosed by guards having graceful lines. Bolts and nuts are concealed and wherever practicable one or more parts have been combined to reduce their number as well as to add to the general appearance of the machine. When compared with the previous machine, *Fig.* 2, these improvements are apparent.

Largely fabricated by welding, many economies have been effected in the redesign through careful planning. Machined surfaces were kept at a minimum. Savings in weight were achieved amounting to 39 per cent and actual number of parts employed was reduced by 30 per cent.

Among the excellent examples of making parts serve more than one purpose is the discharge spout. This serves as an opening for the ejection of paper cuttings and also as a strong beam and stiffener at one of the vital points of the frame. Likewise, at the bottom of the frame a cross member serves as a stiffener as well as a motor support. Covering the sprockets over the feed table is a guard that is used as a shelf for stacking papers prior to shredding. Controls for the conveyor feed are also placed in a more convenient location.

Built-up Weld for Cutter

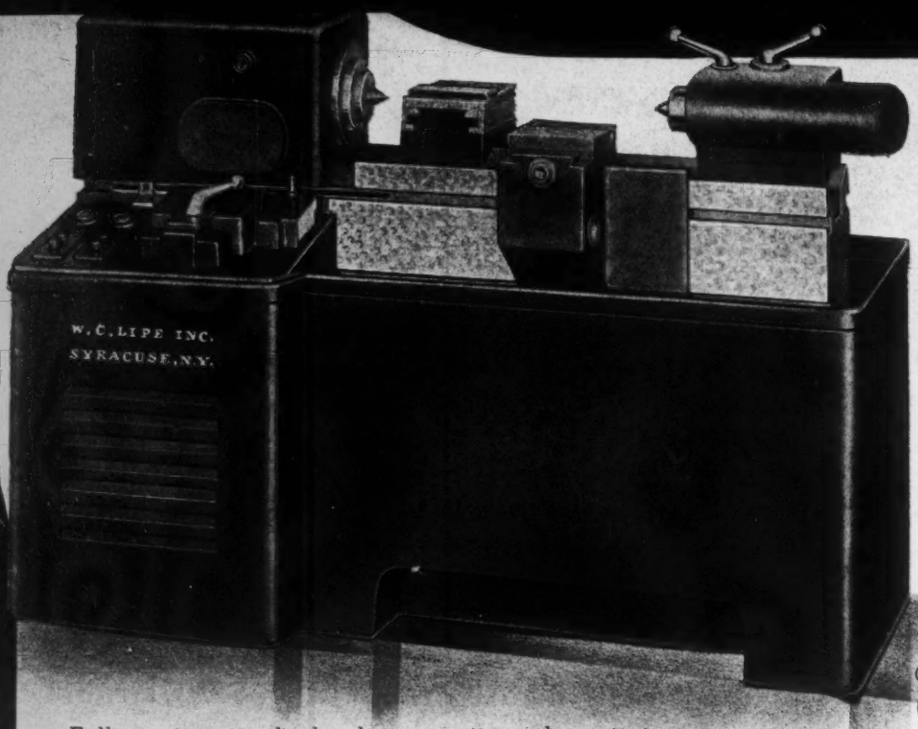
Utilizing a disk carrying straight knives, the cutter on this machine, shearing against a straight bed knife, is sturdy and capable of shearing light metals which might accidentally be included with the paper. The disk revolves at 500 revolutions per minute, making four cuts each revolution. Cuttings are thrown endwise at a high velocity into the discharge spout. Contact of paper with air separates the warped strands completely, producing a resilient mass of shreds. Width of cuttings is controlled by regulating the speed of the conveyor belt leading to the knives through a variable transmission.

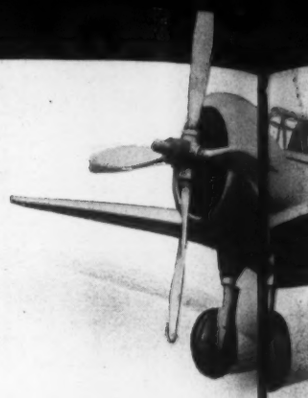
Parts that are subject to wear are the cutting knives carried by the disk and the bed knife against which these knives cut. These parts have been changed in the redesign from solid tool steel to a low cost carbon steel having cutting edges built up by electric welding. This change effects initial economy while permitting regrinding and re-edging a large number of times.

Weight of the disk has been reduced over 50 per cent. Because of this reduction in weight a two-horsepower, standard squirrel-cage motor can now be used, whereas with the previous disk it was necessary to use a three-horsepower, high torque, low starting-current motor. The smaller motor will run more nearly at its rated capacity.

From the foregoing discussion it will readily be seen that all these improvements make for a more serviceable machine as well as one that is more economical and attractive.

*From a Lincoln Foundation award paper by C. W. Willits, Mitts & Merrill Co., Saginaw, Mich.





Pitch of four-bladed aluminu er on
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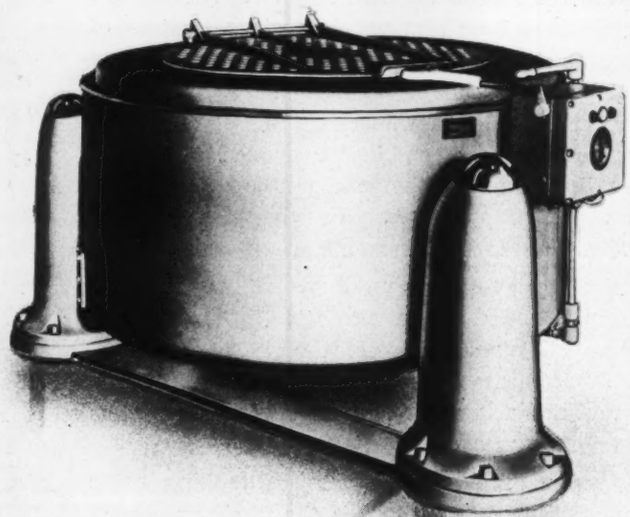
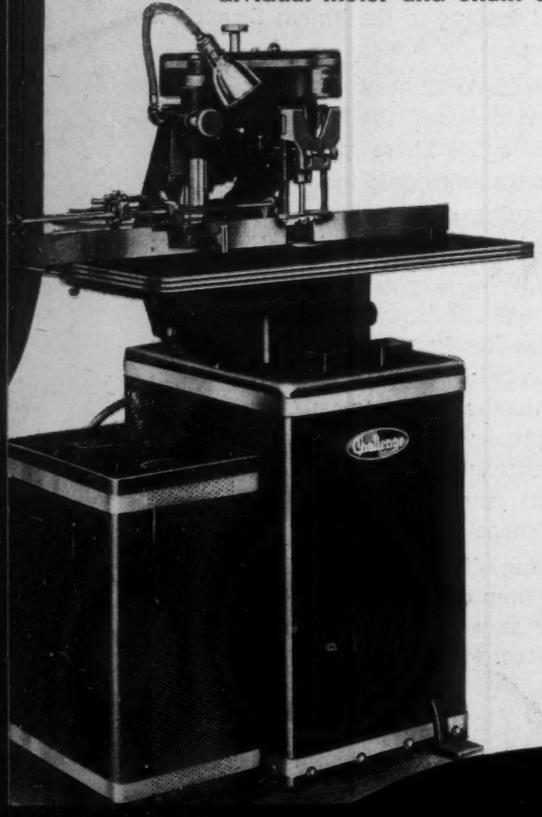
Fully automatic hydraulic operation characterizes the Lipe Carbo-Matic lathe (above), a conveniently tilted control panel being located in front of the headstock. An outboard bearing holds the clutch unit true, eliminating distortion of pulley shaft if overloaded. A single built-in gear pump lubricates all sliding surfaces, bearings and hourglass worm gear unit which eliminates backlash. Three-point suspension prevents distortion of headstock or bed

Control station of the Super Ironer extractor (below) includes automatic timer and solenoid controls for operating the automatic self-energizing brake and cover interlock. Interlock precludes opening of cover while basket is in motion or starting basket while cover is open. Vertical drip-proof motor drives basket by V-belts. With three-point suspension, the machine has a curb of welded steel, aluminum cover, stainless basket



A great safety factor is provided in the Challenge paper drill (below) through the application of hydraulic power, stemming from a separately controlled electric motor, to the up-and-down movement of the drill spindle and through placing the drill under full operator control. With the fully automatic side feed gage, the side guide is moved from station to station and returned to the starting point when the lift of paper is changed, by a small individual motor and chain drive



Three cold rolled steel stampings, polished and chromium plated, form the outside shell of the Sunbeam automatic toaster (right), held together at the molded phenolic plastic base. A knob on the exterior regulates amount of heat received by the operating thermostat. Automatic "pop-up" control of toast is provided through release of a spring by movement of the switch assembly as it opens on terminating the toasting cycle

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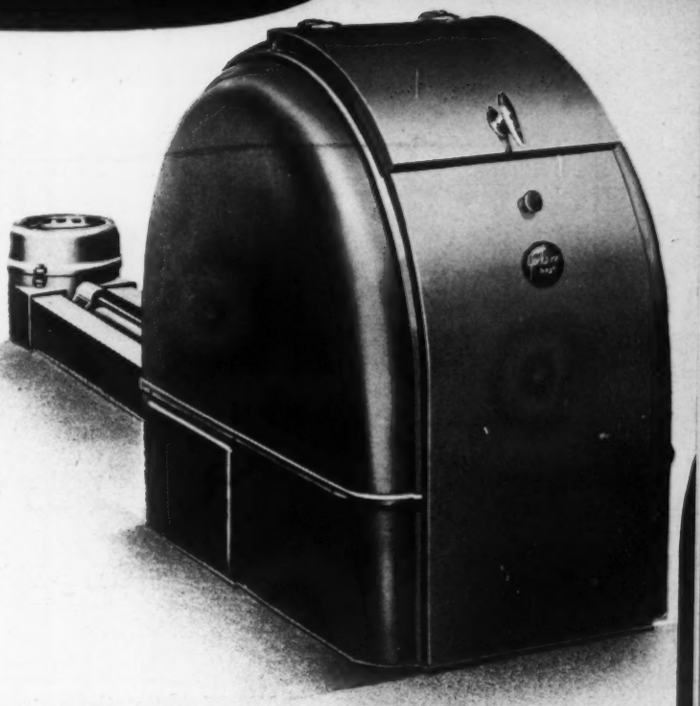
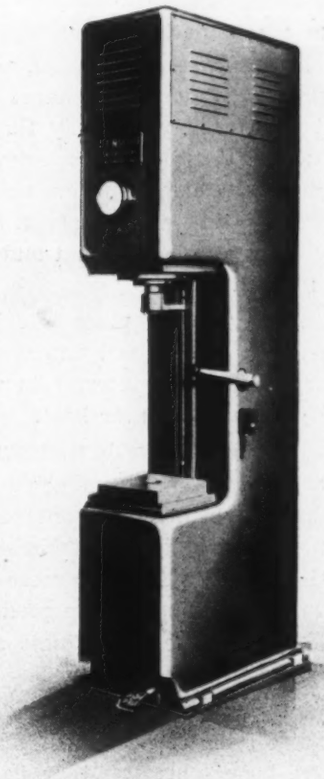
uminu er on the Curtiss pursuit plane (above) led. an increase in effective blade area aded s, it absorbs more horsepower and "prop er. Hence it will allow power plants ced o ngined ships. It has other features of sele rsible pitch control, full-feathering



Ram of the Denison hydraulic press (below) is kept from rotating by machined alloy guides in the throat of the press. Flange-mounted in the upper portion of the welded "C" frame, the steel cylinder is fitted with nickel iron heads and piston and steel piston rod. The hydraulic pump, integrally flange-mounted on its driving motor, is also located in the upper frame. Oil reservoir is under the motor compartment



Overload release on the York bituminous stoker (above) is provided by automatic disengagement of a spring-loaded cam driven by a second cam on the driveshaft. Casing of the hopper is heavy gage, copper-bearing steel; retort is cast iron. To proportion the correct amount of air for combustion, air flows past a damper which is closed automatically when resistance at the retort decreases and air velocity increases

HIS MONTH'S COVER. More easing in appearance than conventional paratus, each Westinghouse pumping tor in the Eagle Mountain station of the lorado river aqueduct has motor and oler contained in a single cleanlined it. Largest in the world, these pumping tors have rotors with specially de- ned winding to give improved torque. Kingsbury type thrust bearing mounted each vertical synchronous unit deliver- g 12,500 horsepower at 450 revolutions r minute, supports the combined weight rotating element, pump, water thrust

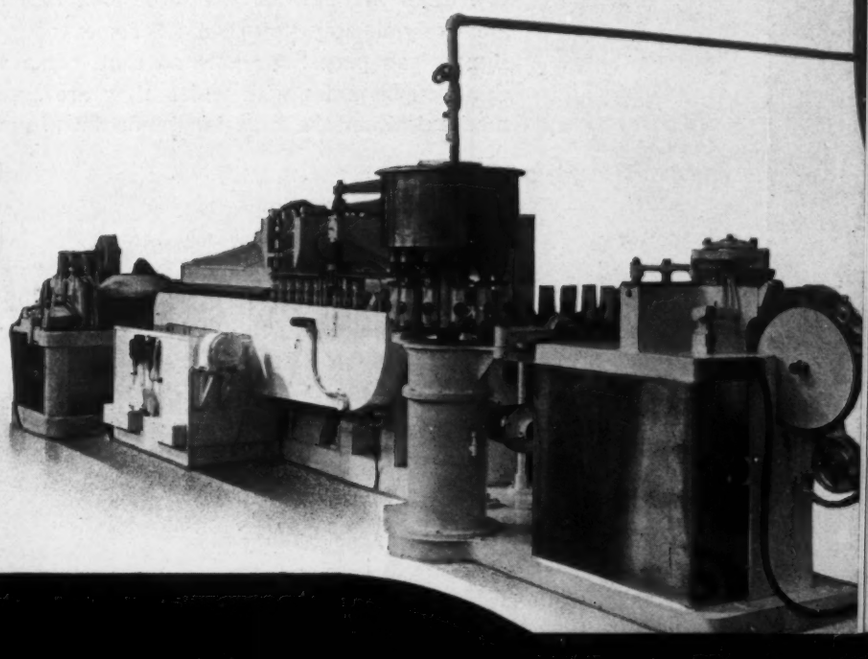
esn Features
w Machines

ict Presentation of Recent Ma- ner the Standpoint of Design

w machine listing see page 98)

Photoelectric controls on the Reed San-O-Matic machine (below), which makes, fills and seals fiber milk containers, stop the machine if paper supplies are exhausted or if paper blanks are placed imperfectly. Fully automatic, the machine's operating mechanism is totally enclosed, with the smooth exterior characteristic of sanitary dairy machinery. All parts meeting steam or water are stainless steel, including a heat treated grade for wear resisting parts. Cams and other drive mechanisms are heat treated Meehanite iron

Versatile Hamilton Beach mixer (left) has small motor operating on either direct or alternating current up to 75 cycles. Drive is worm gear of phosphor bronze. Chromium plated beaters are mounted in a single, guarded, easily detachable frame. Finish is baked enamel with molded plastic handle



Time Has Come To Eliminate the Hangover of Conservatism!

EVERY indication points to a stimulation in business in the near future such as we have never before experienced. An opportunity like this can not be lost, presenting as it does the chance for design to forge still further ahead. During the past ten years only those machinery manufacturing companies who were willing to take the risk developed radically new models—and in practically every case came out on top. With the picture changing rapidly, even the concerns who were held back by conservatism during the depression will be likely to drop their restraint and again furnish strong competition in the machinery market.

That such transitions are already taking place is evident from the present intense quest for designers. On every hand one sees evidences that engineering staffs are being enlarged and that interest in new designs is being whipped up to what may shortly amount to fever heat.

One of the reasons for the changing tempo is that many aggressive manufacturers' eyes are focused on requirements from abroad as well as on domestic demand. Apart from the doubtful settlement of the question as to whether this country will furnish war equipment to belligerents, innumerable foreign markets are now opening up that formerly were more or less closed. Development of these markets and of the appropriate goods to fill their requirements may well mean tremendous increase in business activity with further resultant stimulation throughout domestic industry.

The position of the engineer responsible for design of machinery is clear. For years he has to a large extent been stifled in his efforts to create designs that would appeal to prospective buyers because they in turn were stifled by conditions brought about by depression, politics and recurring threats of war. The cards are now on the table and, barring a revolutionary turn of events, are likely to stay upturned for some years. It is during this period that designers can play their part so that, come what may, both they and the machinery companies with which they are associated will emerge, both from the mechanical and the financial standpoints, in greatly enhanced positions.

Professional Viewpoints

MACHINE DESIGN WELCOMES COMMENTS FROM READERS

" . . . . converters generate heat"

To the Editor:

ENERGY losses in hydraulic torque converters with subsequent heating of the oil are not generally appreciated despite the fact that considerable information has been published on hydraulic systems and much interest has been shown regarding their many possible applications and advantages.

In some systems the heat losses may be utilized as for instance in a steam turbine where the oil is used to heat boiler feed water thus keeping up the overall efficiency. With internal combustion engines, however, no use can be made of this heat. It must be dissipated into the air by means of a radiator or similar method. It is just so much waste of original B.t.u.'s in the fuel.

High efficiency is possible only over limited ranges. To get the best out of a system it should be used in conjunction with a change gear set. That is proven in bus installations where, when the 1:1 ratio is approached, a mechanical clutch takes hold and the converter is not in use. A true hydraulic converter or transmission should be "hydraulic" all the time.

—AUSTIN M. WOLF
New York

" . . . . used high strength alloy"

To the Editor:

AN AXIAL flow type of fan inherently operates at a relatively high speed and it is therefore essential that a material be used which is not only of high strength but which has a high strength to weight ratio and a low unit weight to keep the cost of shafts and other details low. These qualities are required especially for a recently developed fan of the axial flow or propeller type which is unique in having its greatest mechanical efficiency near the pressure end of its range instead of near the volume end as all former designs have had. This characteristic makes it suitable for many of the duties heretofore rendered only by fans of the centrifugal type. It is also desirable to have a material which is resistant to the corrosive effect of as many vapors and gases as possible especially water vapor, solvents and weak acids.

For these fans we selected Aluminum Co. of America's patented alloy No. 356-T6. This is an aluminum-copper alloy with silicon and magnesium as hardening agents and responds to heat treatment processes. It has proven very satisfactory from a corrosion standpoint as well as from a foundry standpoint. We get very accurate and smooth castings in forms having very extended, thin sections, and high strength.

—M. S. LEONARD
B. F. Sturtevant Co.

" . . . . unjustified antagonism"

To the Editor:

ONE would think that an abundance of evidence had been published over the last several years regarding the advantages of the machine. This is an expression of opinion you have often stressed. Yet the unjustified antagonism to the machine continues, and perhaps is even increasing. Why?

The answer seems clear. We have not had the evidence properly presented. I have not seen a single presentation where the facts were not mixed with errors or fallacies. What pretends to be evidence is often the crudest of propaganda, which sounds pleasant to those who wish to hear it, but which is useless to the informed person, and which tends to strengthen the foes in their antagonism to the machine.

Like many movements, there is often more to be feared from the irrational extremists among the supporters than there is from the foes. We need evidence on the relation of the machine to employment, and we need to have it well presented. But what can we do as long as we permit the extremists to parade their transparent fallacies without protest? They can drown out reason.

—A. W. FORBES
Worcester, Mass.

" . . . . curves are valuable"

To the Editor:

CURVES of the kind published in K. E. Bisshopp's article on *Computing Eye Rod Stresses* in the September issue of MACHINE DESIGN are always valuable to designers simply because the computations involved are cumbersome and difficult to make without errors. I was particularly pleased when the author showed exactly what his assumptions were so that everybody who has to deal with eye-rods can determine if the curves apply directly to his case.

—G. B. KARELITZ
New York

ASSETS *to a* BOOKCASE

Lubricants and Lubrication

By James I. Clower; published by McGraw-Hill Book Co., New York; 448 *pages;* 6 *x* 9 *inches, cloth bound; available through* MACHINE DESIGN, $5.00 *postpaid.*

This book, following the author's self-professed aim to be practical, avoids emphasis on certain specialized phases of the subject and on topics like the mathematical theory of lubrication which are covered fully in other volumes. Instead, the author has endeavored to present information more directly useful to designers and other specifiers of lubricants. Believing it is necessary to possess some knowledge of the source, production, refining and theory of lubrication, however, if lubricants are to be selected and applied properly, Mr. Clower has treated those subjects at some length.

As applied to all types of machinery and industry, the fundamentals of lubricants and lubrication are discussed in the first eleven chapters. The following six are devoted in detail to the lubrication of machines universally used in industry: Steam turbines, steam engines, air compressors, refrigerating machines and all types of internal combustion engines. Finally, the last chapter points out general principles and practices of storing and handling lubricants. The appendix contains tables and charts for making volume and gravity corrections and viscosity index determinations.

□ □ □

Protective Coatings for Metals

By R. M. Burns and A. E. Schuh; published by Reinhold Publishing Corp., New York; 385 *pages;* 6 *x* 9 *inches, cloth bound; available through* MACHINE DESIGN, $6.50 *postpaid.*

Covering all types of protective coatings for metals, including paints, lacquers and enamels, this American Chemical society monograph No. 79 is a revision of an earlier work, H. S. Rawdon's *Protective Metallic Coatings,* which confined itself to corrosion-resistant metal finishes. Separate chapters are devoted to detailed discussion of all the important methods of applying protective coatings, hot-dipping, metal-cladding, electroplating and sherardizing.

To bring designers up to date, the book treats approved methods of testing metal and paint coatings by exposure to varied atmospheric and soil environments and gives the results of numerous tests recently conducted. Because advances in organic finishes have been especially notable in the last decade, emphasis is laid on the composition and properties of enamels, paints and lacquers, and particularly on synthetic resins. Factors determining durability of paints and methods of evaluating endurance are covered fully.

The designer will particularly like those sections dealing with some of the latest improvements in electroplating, such as "bright plating" and the anodic oxidation process for aluminum. It has been said, for instance, that without the latter process the position of aluminum as a successful engineering structural material might have been hampered. The same is true of magnesium.

□ □ □

Applied Economics for Engineers

By Bernard Lester; published by John Wiley & Sons Inc., New York; 455 *pages;* 6 *x* 9 *inches; cloth bound; available through* MACHINE DESIGN, $4.00 *postpaid.*

Because engineers too often have insufficient training in practical principles of economics, this book has been written in an effort to fill that gap. Sections of particular interest to designers are those dealing with development, pricing, standardization, cost, and methods of planning. The author has recognized, in other words, the importance of the cost-quality relationship, which must be held in nice balance when laying out a machine.

Contributions of publications toward keeping engineers up-to-date on latest trends are emphasized by Mr. Lester. He points to MACHINE DESIGN's annual Directory of Materials, for instance, when he mentions the vast number of materials designers now have at their disposal. Read carefully, the book should open the way to smoother co-operation between designers and the members of industrial organizations who are concerned with the actual production and distribution of machines.

Men of Machines

WITH a background of twenty-nine years in engineering and designing heating equipment, Edward R. Downe, formerly with American Radiator Co., is in an excellent position to fulfill his new duties as chief engineer of Bryant Heater Co.

Mr. Downe joined the American Radiator Co. immediately after graduating from Worcester Tech in 1910, and worked in the company's plant in Germany for five years. After military service during the War in the 2nd Engineers of the famous Second Division, he rejoined the American Radiator Co. as director of the gas utilization department. There he had full charge of development and production of all the company's gas-fired heating equipment. When the American Gas Products division was formed in 1931, he served as vice president in charge of production and engineering, until his present appointment.

EDWARD R. DOWNE

HAVING been connected with Leeds & Northrup Co. continuously since 1909, Charles S. Redding, formerly vice president in charge of research and engineering, has become president of the company. He first became connected with the company's predecessor, Morris E. Leeds & Co., for a fifteen-month period between his high school and college years. After receiving his electrical engineering degree from the University of Pennsylvania in 1906, he remained there for two years as instructor in mechanical engineering. For a time he was associated with the Engineers Club of Philadelphia. In 1909 he again returned to the Leeds company, beginning as salesman, and has since held executive positions in every division of its activities. He became second vice president in 1918, treasurer from 1922-1924, and from 1928 until his recent promotion held the position of vice president in charge of research and engineering.

CHARLES S. REDDING

ARTHUR NUTT

RECENTLY nominated for president of the Society of Automotive Engineers, Arthur Nutt, vice president in charge of engineering of Wright Aeronautical Corp., Paterson, N. J., has been active in the affairs of the society during the past 15 years.

Born in 1895, Mr. Nutt is a native of New Rochelle, N. J. He attended grade and high schools in Worcester, Mass., and graduated from Worcester Polytechnic institute in 1916 with a mechanical engineering degree. Until 1920 he was test engineer for the Curtiss Aeroplane & Motor Co. He then served as chief engineer until 1930 when the Curtiss and Wright merger took place. At that time he was made vice president in charge of engineering of Wright Aeronautical Corp.

Mr. Nutt has assisted in developing many Curtiss engines. He was

in charge of design and development in 1922 of the Curtiss D-12 water-cooled 435-horsepower engine, which was in production for ten years. He was also responsible for the design of the company's chemically-cooled 12-cylinder engine, the first engine designed and produced in quantity with this type of cooling; 9-cylinder air-cooled engine, the first of its type with built-in supercharger and fully-automatic lubricated valve gear; six in-line air-cooled 120-horsepower engine and the 2-row training engine, 6-cylinder, air-cooled. Many experimental models also have been designed in the engineering department under his supervision.

♦

D. P. DAVIES, vice president in charge of engineering of J. I. Case Co., Racine, Wis., was tendered a dinner in recognition of his long service with the company and in testimony of his producing a new tractor. Mr. Davies has been connected with the company since 1886 and helped build the first gas tractor on record. He then left the company for thirteen years during which he was sent to Europe by a large manufacturer to study gas engines. Returning in 1910 he built a number of high-powered engines which are believed to be still in operation.

♦

ARTHUR C. EVANS is now a member of the engineering staff of the Road Machinery division, Gar Wood Industries Inc. Mr. Evans was formerly connected with the Continental Roll & Steel Foundry Co. tractor equipment division, recently acquired by Gar Wood.

♦

JOHN S. BARTEK has been added to the engineering staff of the Pioneer Engineering & Mfg. Co., Detroit. He was previously chief engineer of Modern Tool Works.

♦

PHILIP G. JOHNSON has been elected president of both Boeing Airplane Co. and Boeing Aircraft Co. Mr. Johnson joined the Boeing company in 1917 as draftsman in the engineering department, subsequently working up into executive positions of the company.

♦

NATHANIEL BREWER has recently joined the staff of Stock Engineering Co., Cleveland, as consulting engineer. He was formerly associated with Sharples Corp., for a number of years in development work.

♦

DR. FRANCIS M. WALTERS has been appointed to the naval research department, Washington. He was previously connected with Youngstown Sheet & Tube Co., Youngstown, O., in its research department.

♦

NORMAN N. TILLEY, chief engineer of the Detroit plant of Continental Motors Corp., has become associated with Lycoming Mfg. Co., Williamsport, Pa.

Nameplates Enhance Appearance

(*Concluded from Page* 39)

carrying out the theme established for the machine. Nameplate and operating plate are balanced.

In some instances one plate serves for everything: Identification, data and controls. *Fig.* 1, besides illustrating the streamline form, is a good example of design ingenuity in co-ordinating dissimilar material and giving it style and character.

Types of Plates Available

TRANSFERS: Also called decalcomanias. A wide variety of color combinations is possible. Avoid designing transfers that require half-tone screens; metal inks, too, are not particularly successful. Decalcomanias cannot be placed on a surface curved in more than one plane.

GUMMED LABELS: There are many varieties of gummed labels, some made with metal foil. If properly designed, they are attractive. Avoid too many colors and keep metal areas well defined.

PLASTICS: Urea plastics, with their brilliant color range and fastness to light have great possibilities. Lettering may be raised, or depressed and "wiped-in" with a contrasting color. The transparent plastics in the acryllic and polystyrene groups, with their possibilities for three-dimensional effects, are being exploited more and more for high-class products where their relatively high cost is not a deterrent.

METALS: Metal plates are produced in many ways. They may be sand cast, stamped, coined, etched from sheet stock, lithographed, etc. Many materials are used, including steel, brass, zinc, aluminum, and bronze. Color may be applied in several ways, and there are many ingenious devices for fastening these plates to sheet metal and castings without showing the means of fastening.

VITREOUS ENAMEL: Porcelain fused on steel offers possibilities in the larger sizes. For outdoor applications, where weather conditions are severe, only bronze is superior. Vitreous enamel plates must be designed with generous radii to avoid chipping. Various colors can be used, and by means of the silk-screen process or vitreous transfers, intricate and subtle designs can be produced.

DIE STRIKING: On certain products, mentioned before, identification must be present but not immediately visible. Some are subject to heat, frequent washing, or abrasion and may be die struck on the bottom with hardened steel dies, thus impressing in the metal the maker's name or trademark.

The design and execution of identification marks, data plates and accessories must be done well if a design is to possess those last refinements of detail which are so important.

NOTEWORTHY PATENTS

Radial Engine Powers Front Wheels

TUBULAR frame, radial engine, front wheel drive characterize the departures from conventional in the automobile design covered by patent 2,159,332 and assigned to Chrysler Corp. by Roger K. Lee. This unusual design is shown schematically in *Fig.* 1.

The entire weight of the engine, clutch and transmission is carried by the front wheel suspension. Thus

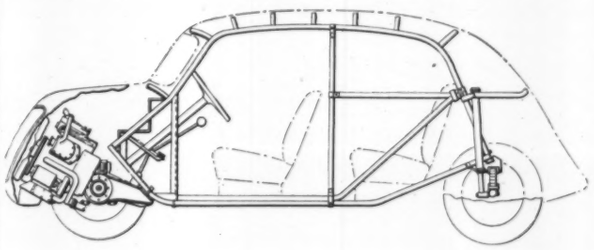


Fig. 1—*Engine, clutch, transmission are assembled in unit construction in this radial engine front wheel drive*

the frame structure does not directly oppose traction torque and may be lighter and more economically fabricated. The engine unit is maintained in static balance by connecting units and an unbalanced mounting. Direction of application of both engine and traction torque reactions is so determined as to dissipate the energy by controlled movement of the engine unit about a single axis. Rubber mountings are utilized to provide resiliency and absorb vibration. Assembled in unitary construction the engine clutch and transmission are detachable from the body and may be removed on the road wheels.

Crusher Utilizes Floating Eccentric

CONSTANTLY changing radial thrust is imparted to the crushing head of the centrifugal crusher shown in *Fig.* 2 yet leaving it free to yield to a resistance in excess of its designed value. This thrust is imparted by a crank at the bottom of the drive shaft and a floating eccentric bearing.

The eccentric bearing, between the crank and crusher member, acts as a shiftable cam rotatable upon the crank. Normally centrifugal force determines the amplitude of the thrust imparted to the crusher head. Thrust of the cam however is sufficient to neutralize the thrust on the head and enable it to ride over a mass of material with excessive resistance allowing gradual reduction.

Counterweights are shown positioned to balance the forces set up in the shaft, crank, and the oscillating crusher head. Another feature provides for adjusting the grinder by moving the stationary shell with the eyebolts, thus not affecting the interrelation of any of the moving parts. Designed by Rowland W. Rider and covered by patent 2,168,582 this pump is assigned to Utah Royalty Corp., Salt Lake City, Utah.

Controls Consistency of Fluid

FOR use where accurate control of fluid consistency is required, as for pulp solutions in paper making, the device seen in *Fig.* 3 regulates the consistency according to its resistance to rotation of a helical paddle wheel. Because resistance varies as the consistency of the stock, the control element is enabled to maintain a solution at the proper valve.

Counterbalanced with proper weights according to the consistency desired the control element rises or falls with rotation as the consistency varies because

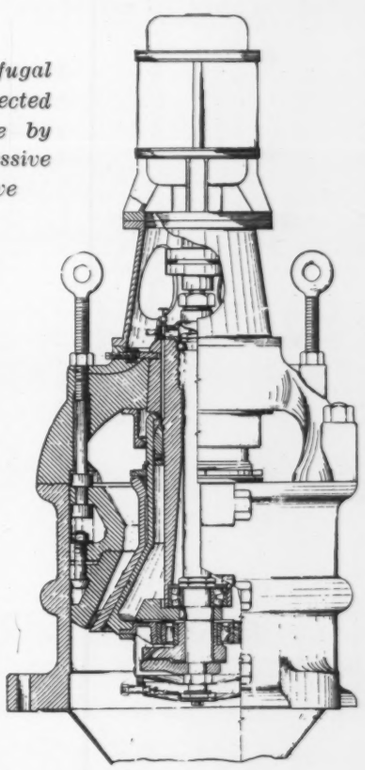


Fig. 2 — *Centrifugal crusher is protected against breakage by yielding to excessive resistance valve*

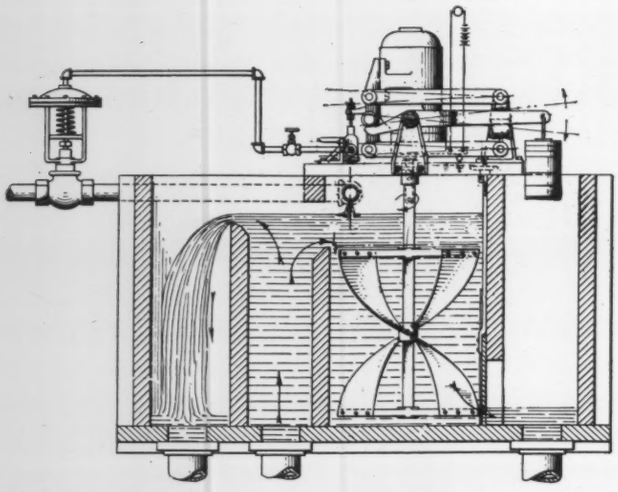


Fig. 3—Consistency of fluid is kept constant with helical paddle control unit

of the helical screw construction of the paddle. The position of the control element determines the amount of valve opening to admit the diluting fluid. As proper consistency and stability of the element are approached the valve closes.

Admission of additional solution increases the consistency. The paddle rises and more fluid is admitted as the system operates to keep the consistency constant. Should the consistency fall below the valve which the device can control a limit switch is engaged by a lever and a signal informs the operator. This device, covered by patent 2,171,312, was designed by Sidney E. Meyers and assigned to Control Equipment Corp., Buffalo.

Capacity of Spring Clutches

(*Concluded from Page* 46)

comes very small and the equation may be written

$$T = r_2^2 f_0 \quad \ldots\ldots (2)$$

If $N\mu = 1$ this expression is in error by only .2 per cent. The torque therefore depends only on the radius of the arbor and on the force f_0 which is controlled entirely by the dimensions and the elastic properties of the spring.

If the torque is applied to the clutch in the direction to wind the spring, the relation corresponding to the above equation becomes

$$T' = r_2^2 f_0 (e^{2\pi N\mu} - 1) \quad \ldots\ldots (3)$$

In this case the torque increases rapidly with an increase in either N or μ especially for large values of $N\mu$. The coefficient of friction is in general a variable factor. It is to be expected that the slipping torque will also be variable, but since a lower limit can in general be set for this coefficient it will always be possible to make the number of turns of the spring such as to give any desired lower limit of torque.

One method of evaluating the force f_0 occurring in the torque relations depends on equating the potential energy of strain per unit length of the wire when on the arbor to the work done in expanding the spring from its free diameter to the diameter of the arbor. It may then be shown that this force is

$$f_0 = \frac{EI(R_2 - R_1)}{R_1 r_2 R_2^2} \quad \ldots\ldots (4)$$

The value of f_0 calculated from this equation in terms of the constants of the spring material and the dimensions of the spring may be used in Equations (2) and (3) to calculate the free torque and the slippage torque of the clutch.

In determining the load that a spring clutch will withstand, first without stretching which would result in backlash, second without breaking, initial as well as load stresses must be considered. The initial stresses are made up of the residual stresses due to forming the spring, plus the stresses due to expanding the spring to fit the arbor. Torque required to break the spring is the product of the radius and the breaking strength of the spring wire. Loads much smaller than this, however, would stretch some of the fibers of the spring, especially those in which a high initial stress already existed. The maximum fiber stress due to placing the spring on the arbor is (referring to *Fig.* 3, page 46).

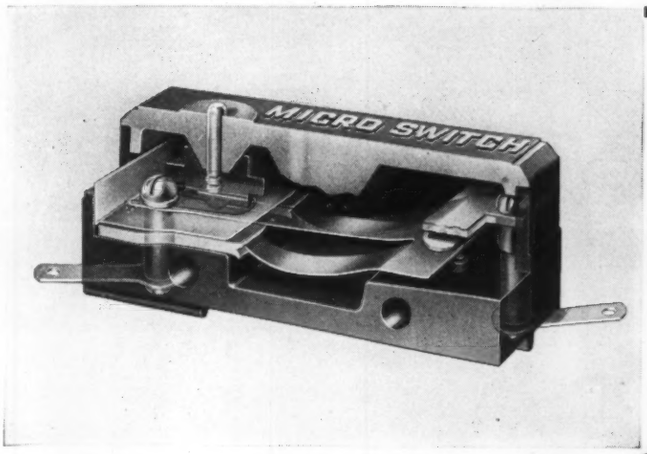
$$S_0 = \frac{h}{2R_2} \frac{R_2 - R_1}{R_1} E \quad \ldots\ldots (5)$$

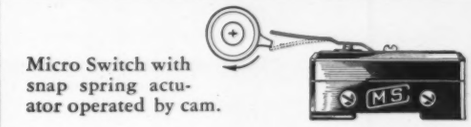
Since a load on the clutch results in a tension in the spring, the stress given by Equation (5) must be added to the load tension stress to get the total stress on the inner fibers of the spring. This initial stress therefore reduces load-carrying capacity of clutch.

These relations are sufficient to determine the correct spring dimensions for a spring clutch of specified free and gripping torque provided the material constants and the cross-sectional shape of the wire as well as the length and diameter of the clutch arbor are specified. Choice of values for the last two factors is based largely on permissible heating resulting from the slipping in the free direction. Furthermore, as would generally be the case, if only maximum values of the free torque and minimum values of the gripping torque are given a number of solutions can be obtained from which to choose the most convenient.

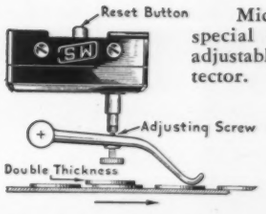
Symbols

μ = coefficient of friction between spring and arbor
r_2 = radius of arbor, inches
R_1 = free radius to the neutral axis, inches
R_2 = radius of neutral bending axis of spring, inches
N = number of turns on right hand arbor
f_0 = radial force of spring on arbor when no torque is applied, pound/inch of contact line.
E = Young's modulus for spring material, psi.
I = area moment of wire section, inches^4
h = radial thickness of wire, inches
T and T' = torque, pound-inches
S_0 = fiber stress, psi.



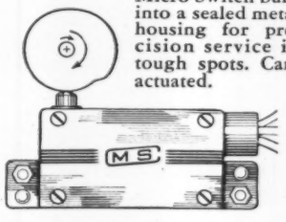


Micro Switch with snap spring actuator operated by cam.

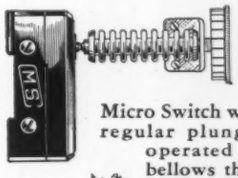


Micro Switch with special plunger as an adjustable thickness detector.

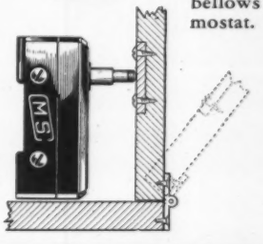
Micro Switch with snap spring actuator used as a break indicator.



Micro Switch built into a sealed metal housing for precision service in tough spots. Cam actuated.



Micro Switch with regular plunger operated by bellows thermostat.



Micro Switch with plunger used as a door switch.

MICRO MS SWITCH

If you use time, temperature, pressure, weight, relay, or solenoid controlled devices or fractional H. P. motors in the manufacture of your product, you can apply the Micro Switch to advantage. It is now used on products in this partial list of classifications.

CONTROLS

Air Conditioning__Blower and Draft__Boiler__Cycle Circuit__Damper Regulators__Electric Furnace__Magnetic__Pressure__Test__Gate Control__Relays__Signals__Interlocks__

INSTRUMENTS

Flow Meters__Fuel Indicators__Fuel Tank Level Testers__Humidistats__Electrometers__RPM Indicators__Tickers__X-Ray Timing Devices__

THERMOSTATIC DEVICES

Incubators__ Brooders__ Indicating__ Industrial__ Oven__Room__

MACHINES & MACHINE TOOLS

Coin Operated__Automatic Hobbing__Honing__Hydraulic Presses__Automatic Gauging__Bottling__Counting and measuring__Cutting__Die Sinking__Drilling__Tapping__Lathes__Automatic Screw__Milling__Riveting__Packaging__Rubber Working__Printing__Textile__Welding__

SAFETY DEVICES

Burglar Alarms__Recorders__Oil Burners__Stop Light Systems__Traffic Signals__Transformer Protection__

MISCELLANEOUS

AnnunciatorSystems__Counting Devices__Direction Indicators__Daters and Printers__Flashers__ Cameras__ Oil Regulators__Phonographs__ScalePivots__Scale Weight Printer__Steaming Devices__Animated Displays__

A compact, sensitive, light weight snap action switch that is only $1\frac{15}{16}$" long, $\frac{7}{8}$" high and $\frac{3}{4}$" deep, and weighs only 1 ounce—operates precisely on small energy, small movement and small force at speeds as high as 600 times a minute. . . . It is rugged, resists vibration, needs no leveling, endures millions of operations. . . . It has a conservative rating of 10 amperes at 125 volts A.C.; 5 amperes, at 250 volts A.C.; 3 amperes, 460 volts A.C.; 2 amperes, 600 volts A.C.; and is adaptable to loads of ½ H. P., 115 to 460 volts; 1200 watts, 115 to 600 volts. It is listed by the Underwriters' Laboratories and the Hydro-Electric Power Commission of Ontario. . . . If your problem involves any of the operating factors; or your product is similar to those listed on the left, we will be pleased to work with you.

MICRO MS SWITCH

MANUFACTURED IN FREEPORT, ILLINOIS BY

MICRO SWITCH CORPORATION

New York Chicago Boston

NEW Materials and Parts

(For Engineering Department Equipment see Page 76)

Wide Use Seen for Aluminum Bearing

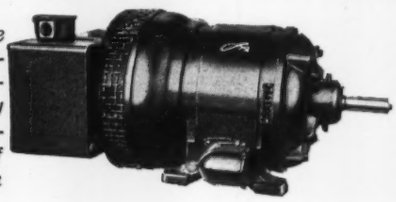
DEVELOPMENT of an aluminum alloy automotive bearing with simple construction and high fatigue strength is announced by Aluminum Company of America, Pittsburgh. Applications include main, connecting rod, and camshaft bearings, with use expected to include bus, truck, tractor, diesel, airplane, and passenger car units. Tests have shown

Fabrication is not difficult and customary finishing methods may be used on aluminum alloy bearings

the bearings do not score or lock to the shaft at surface speeds encountered in commercial vehicle engines. Fabrication is not difficult and customary finishing methods are used. Main requirement is that the bearing be cast properly of the correct alloy with a thickness of at least .99-inch. For main and road bearings a permanent mold casting is used, with rolled sheet for camshaft bearings.

Clutch Excitation Controls Motor

WITH no mechanical contact between the driving and driven members of the unit, the Ajusto-Spede motor announced by the Louis Allis Co., Milwaukee, is a combination of an eddy current clutch and a standard constant speed alternating current squirrel cage motor. Speed and torque variations are obtained by controlling the magnetic excitation of the clutch, thereby obtaining any desired slip. Typical applications include printing presses, textile machinery, grinders, glass machines, paper machines, feed and working drives on machine tools, wire drawing machinery. Since the power required for excitation of the clutch is relatively small, remote control is

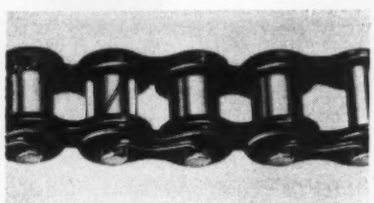


Speed and torque variations in adjustable-speed motor are obtained by controlling magnetic excitation of eddy current clutch

practical and may be made responsive to any type of control. Both the motor and clutch parts are integrally contained within a single housing.

Standardize Lubricated Chain

A CHANNEL lubricated roller chain conforming to American Standard dimensions and completely interchangeable with all other standard roller chains, is announced by Morse Chain Co., Ithaca, N. Y. As in other Morse roller chains diagonal channels are rolled into the stock from which the bushing is formed. When the joint is assembled, these channels appear as spiral grooves and extend through the side plates of the bushing link. Oil on the rollers quickly finds its way to the bushing surfaces, the channels acting not only as reservoirs but as paths



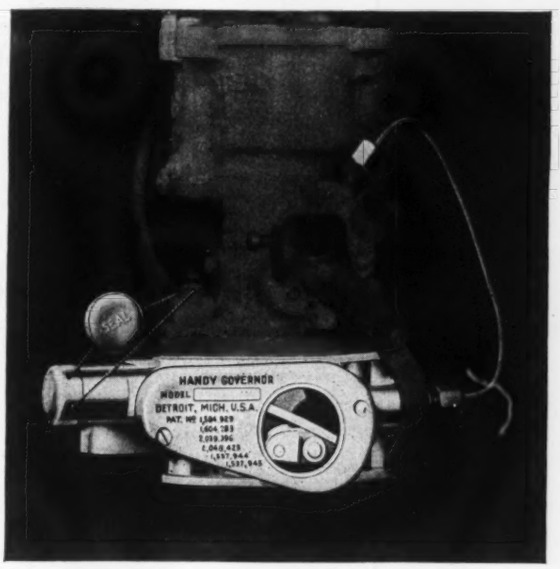
Diagonal channels rolled into the stock from which bushing is formed on new roller chain, act as reservoirs and paths for oil

for the flow of oil through the side plates and down to the pins. Here the lubricant is spread by capillary action in a protective film over the entire contact surfaces of pins and bushings. Rollers are hardened and ground, turned out of solid bar stock alloy steel to attain greater accuracy and wearing strength. The cross section of the side plates has been increased. Single, double, triple and quadruple widths, all stand-

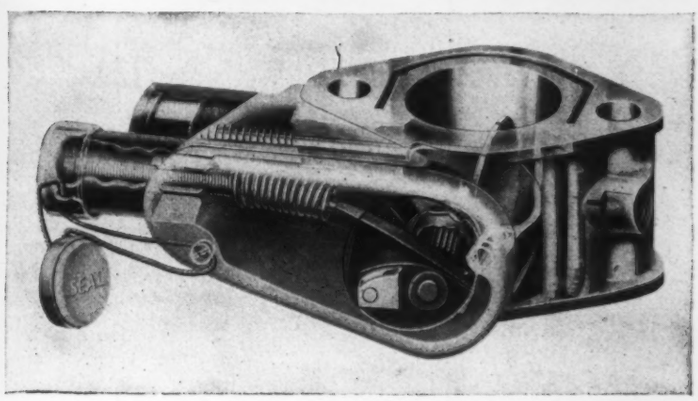
TORRINGTON NEEDLE BEARINGS

INSURE QUICK RESPONSE IN HANDY GOVERNORS

The Handy Governor is the mileage meter of the highways—quick to respond to changes in engine load.



The Handy Governor offers distinctly new features in simplicity, accuracy, and speed range.



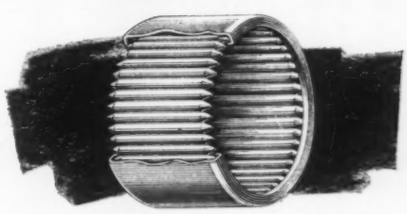
Phantom view of the Governor shows location of Torrington Needle Bearing on the throttle shaft assembly.

QUICK RESPONSE to changes in engine load is absolutely essential in the Handy Vari-Speed Governors used by leading truck manufacturers and operators everywhere. The throttle shaft assembly—one of the three moving parts in the governor—must move freely and without friction.

"To insure the absence of friction at this point," says the Handy Governor Division of King-Seeley Corporation, "our engineers selected Torrington Needle Bearings. So successful has been the use of these bearings that in many cases the operation of Handy Governors is comparable to that of mechanical governors."

Speedy response and smooth operation are not the only advantages found by Handy engineers in the use of the Torrington Needle Bearing. "There is a distinct advantage from the construction angle through the use of the Needle Bearing," reports Handy. "The bearing is so constructed that there is a great saving in vertical space and because of the bearing design we are able to use standard throttle shafts having no special shoulders."

This adaptability to product designs is characteristic of the Torrington Needle Bearing. Because of its simple construction and small diameter, it introduces no design complications; in fact, it frequently offers opportunities for simplification in the design of surrounding members, with consequent savings in space, weight, and cost.



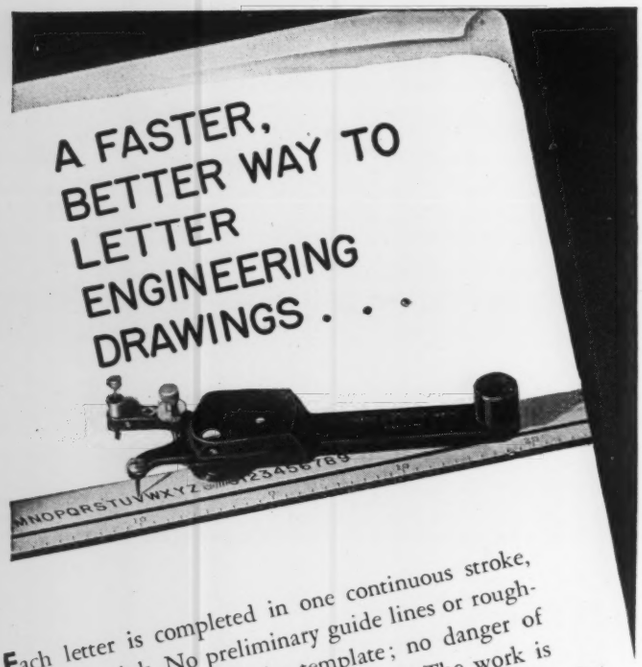
Let the Torrington Engineering Department show you how these and other advantages of the Needle Bearing—low cost, high radial load capacity, thorough lubrication—can be incorporated in your own product designs. For further information write for catalog No. 9. For Needle Bearings to be used in heavier service request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings

New York Boston Philadelphia Detroit
Cleveland Chicago London, England

TORRINGTON
NEEDLE BEARING



Each letter is completed in one continuous stroke, directly in ink. No preliminary guide lines or rough-ing-in; no shifting of the template; no danger of smearing; nothing to erase afterward. The work is performed well above the template, in full view at all times. Leroy lettering is easy and absolutely uni-form. You are sure of perfect lettering *every time.*

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Add Leroy lettering to your drafting room equipment. Your K & E dealer will be glad to arrange a demon-stration — or write for illustrated Booklet No. 101.

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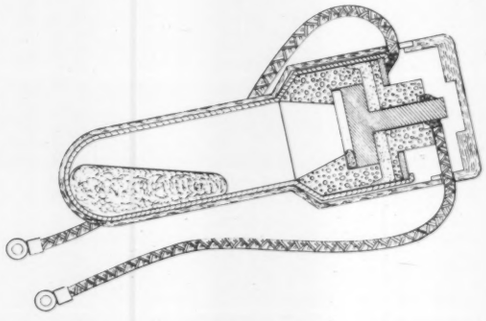
K & E LEROY
REG. U.S. PAT. OFF.
LETTERING SETS

ard pitches and standard stock attachments are avail-able in the improved Morse chain.

Mercury Switch Capacity Increased

IMPROVEMENTS in the Durakool mercury switch first announced several years ago by Durakool Inc., Elkhart, Ind., have increased the capacity of the same sized switch. By using a flange to make the inner elec-trode cup-shaped instead of a flat disk as formerly, the same area of mercury contact is retained with re-duced diameter of the electrode. Greater capacity is thus possible because more insulating ceramic can be used surrounding the electrode. Improved sealing of the shell is obtained by providing on the end a tube which is sealed by crimping, cutting and welding, as with a radio tube, to prevent oxygen from entering. Formerly a screw plug was used as a seal. Instead of either hydrogen or liquid for a fill, the new unbreak-



Cup-shaped inner electrode, hydrogen and liquid fill, and improved sealing method give metal mercury switch greatly in-creased life and higher capacity

able switch has two reducing agents, hydrogen at 60 pounds pressure and the former liquid fill. By this im-portant change, switch life has been increased in the new unit and performance has been tripled on highly inductive loads. As with the former switch, the com-bined metal and plastic totally insulated case (rubber or neoprene cover optional) lends durability, and quick make-and-break results from the construction of the inner ceramic insulation and retained mercury pool. The liquid fill also helps make-and-break because of its oil-like stabilizing film.

Develop Wrinkle Castings Finish

A RECENT development of New Wrinkle Inc., Dayton, O., is the dip-process of finishing cast-ings, an indirect aid in eliminating costly mechanical castings finishing operations. In the process, the casting is dipped in a thin solution of wrinkle finish which insures complete coverage for all exposed sur-faces and securely seals pores on hidden surfaces where rust-proofing is the only duty a finish serves. The casting is then placed on a slightly inclined, re-movable screen-covered rack so the surplus paint is collected in a tray which returns it to the dipping

NO OIL
NO WAX

A newly discovered SYNTHETIC SOLID gives you this age-proof tracing paper

MINERAL OIL. Most tracing papers are treated with some kind of oil. Mineral oil is physically unstable, tends to "drift," never dries completely. Papers treated with mineral oil pick up dust, lose transparency with age.

VEGETABLE OIL, chemically unstable, oxidizes easily. Papers treated with vegetable oil become rancid and brittle, turn yellow and opaque with age.

ALBANITE is a crystal-clear synthetic solid, free from oil and wax, physically and chemically inert. Because of this new stabilized transparentizing agent, Albanene is unaffected by harsh climates—will not oxidize, turn yellow, become brittle or lose transparency.

Here at last is a truly permanent tracing paper. Albanene is made of 100% long fibre pure white rags, treated with *Albanite*, a new crystal clear synthetic solid developed in the K & E laboratories. Albanene is oil free and wax free—chemically and physically inert. It will not oxidize, turn yellow, become brittle or lose transparency with age. Your drawings are protected against the inroads of time!

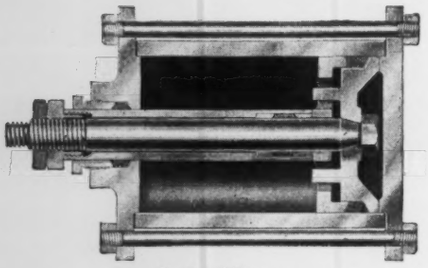
Better still, Albanene has excellent working qualities... an extraordinary strength to stand up under rough handling... a fine hard "tooth" that takes ink or pencil smoothly and erases with ease... a new transparency that makes tracing simple and produces strong, sharp blueprints. Because Albanene is permanent, *it will retain all of these qualities indefinitely!*

Try this improved tracing paper on your own drawing board. Ask your K & E dealer, or write for an illustrated brochure and a generous working sample.

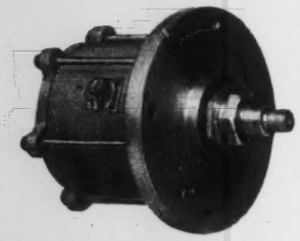
EST. 1867
KEUFFEL & ESSER CO.
NEW YORK · HOBOKEN, N.J.
CHICAGO · ST. LOUIS · SAN FRANCISCO · DETROIT · MONTREAL

K&E Albanene
REG. U.S. PAT. OFF.
THE STABILIZED TRACING PAPER

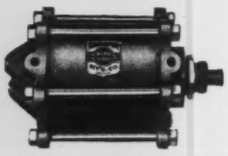
MAXIMUM POWER
AND SUSTAINED HIGH EFFICIENCY OPERATION



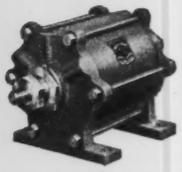
Sectional View



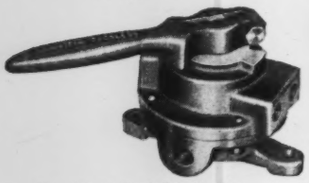
Model JR—double-acting air cylinder



Model BR—double-acting air cylinder



Model CR—double-acting air cylinder



Hannifin "Pack-Less" Air Control Valves available in all types for positive control of air operated equipment.

Hannifin Pneumatic Cylinders provide for maximum utilization of air power, for the exclusive design assures perfect piston fit in a bored and honed cylinder, plus provision for simple, outside adjustment for easy maintenance of high efficiency operation. Cylinders are bored and then honed on special Hannifin long stroke honing machines, producing a cylinder bore that is straight, round, and perfectly smooth. The soft graphite-treated piston packing, easily adjusted, prevents leakage and waste of air power, keeps friction loss at the minimum.

Hannifin cylinders are built in a full range of standard types, sizes 1½ to 16 in. diameter, for any length stroke. Larger sizes built to order. Single or double-acting types, furnished with or without air cushion. Write for Bulletin 34-MD; also for Bulletin 35-MD describing Hannifin Hydraulic Cylinders.

HANNIFIN MFG. COMPANY

621-631 South Kolmar Avenue
Chicago, Illinois

Engineers • Designers • Manufacturers

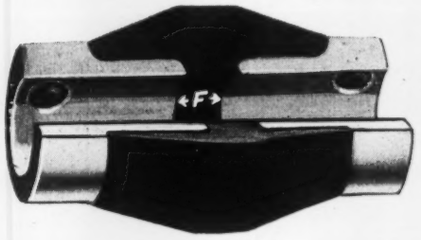
Pneumatic and Hydraulic Production Tool Equipment

HANNIFIN
high efficiency **AIR CYLINDERS**

tank. An opportunity to set is thus given the finish. A quick spraying is then applied. During the baking operation which follows, wrinkle is achieved.

Couplings Accommodate Misalignment

ACCOMMODATING both parallel and angular misalignment, a new line of fractional horsepower flexible couplings announced by Lord Mfg. Co., Erie, Pa., is able to absorb torsional vibration as a result of transmitting torque in shear. The couplings pre-

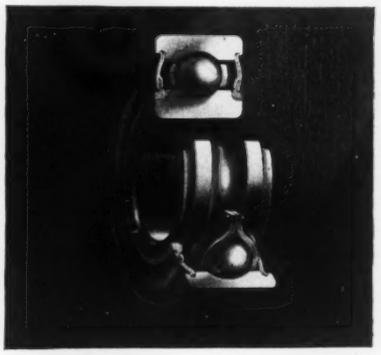


Line of fractional horsepower flexible couplings is able to absorb torsional vibration

vent transfer of gear noise and motor hum through the shaft. These bonded rubber couplings are compact in design, made in sizes from 1/16-horsepower to 1-horsepower. They are made as complete units.

Bearing Seal Touches Inner Race

THE new line of Red Seal bearings developed by SKF Industries Inc., Philadelphia, utilizes a seal that can be applied to bearings having a standard single row S.A.E. dimension of bore, inner and outer race width. Sealing comes from the contact of felt fiber on the polished surfaces of the inner race, and



Sealing in new bearings comes from contact of felt fiber on surfaces of inner race

through use of the natural tendency of deflected felt to resume its original flat shape. The bearing is suitable over a wide range of speeds, is designated 6200 RS, and is available for shafts up to approximately one inch in diameter.

Valve Design Eliminates Galling

COMPLETELY sanitary with no inside threads or pockets, a new line of stainless steel valves for dairy equipment known as Nos. 60 Y, T and C has been introduced by Tri-Clover Machine Co., Kenosha,

In more ways than one. Today the world's largest tire companies use Cuno *continuously cleanable* filters for continuous protection against damaging solids found in water used to cure tires. And the bearings on which today's cars roll are pre-packed with Cuno-filtered grease.

PUT *ACCELERATION* INTO YOUR DESIGN

If you handle *any* fluid, air, gas, liquid; wet, or dry, it can be strained through Cuno filters . . . more efficiently. No machine shutdowns. No production stops. No detouring through a second filter while the first is being cleaned. Wherever and how much of the fluid moves — instruments, tools, and processes are continuously protected.

OF INTEREST TO DESIGN ENGINEERS

The principle of Cuno Filters (edge filtration) is a simple one. Read about it in "80 Ways to Make More Money," which also contains actual case studies in *your* industry. The coupon will bring this to you free.

Cuno Engineering Corporation
271 South Vine Street
Meriden, Connecticut
Please send me, free, "80 Ways to Make More Money."

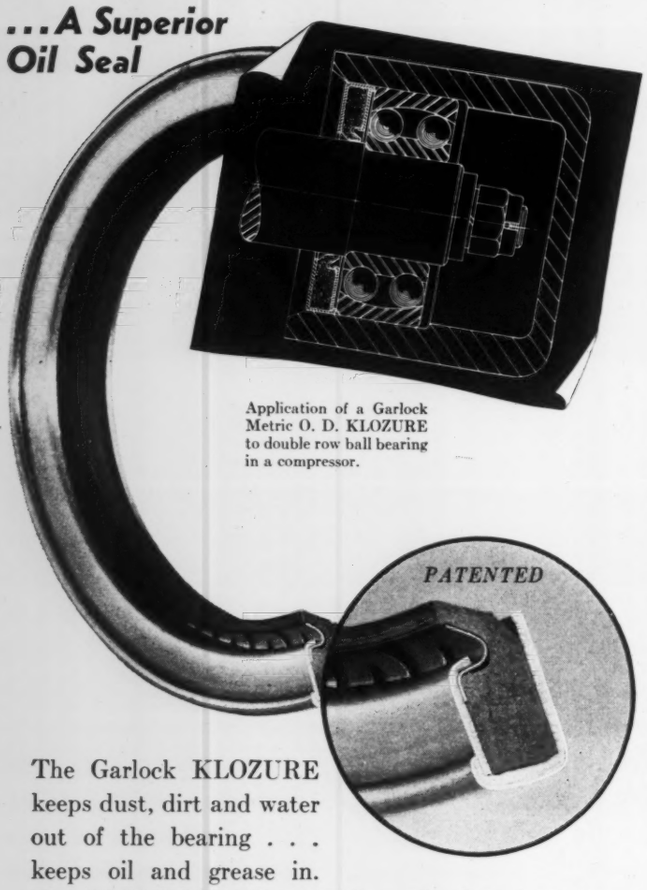
Name.....
Company.....City.....State.....
Street.....

avoid stop and go with CUNO *Filters*

CUNO ENGINEERING CORPORATION ★ MERIDEN, CONNECTICUT

KLOZURE

...A Superior Oil Seal



Application of a Garlock Metric O. D. KLOZURE to double row ball bearing in a compressor.

The Garlock KLOZURE keeps dust, dirt and water out of the bearing . . . keeps oil and grease in. The KLOZURE sealing ring is made of an *exclusive* Garlock compound which resists oil and water at high or low temperatures. It is dense, grainless, tough and resilient . . . does not become soft and flabby in service. Complete range of sizes. Write for catalog!

METRIC O.D.'S

To provide an oil seal that fits into the same housing bore that receives ball and roller bearings made to Metric O.D.'s, Garlock now manufactures a line of KLOZURES with Metric O.D.'s. The usage of Metric O.D. KLOZURES frequently results in a considerable saving in machining and tooling costs. Also cuts down installation time. Write for further details.

THE GARLOCK PACKING CO.
PALMYRA, NEW YORK

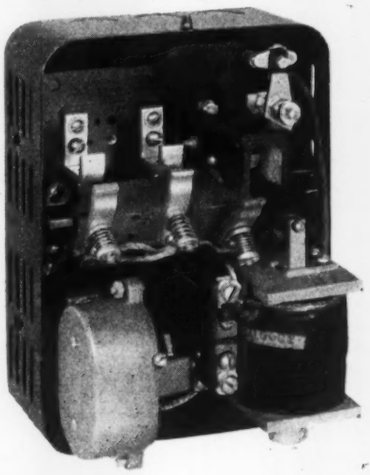
In Canada: The Garlock Packing Co. of Canada Ltd. Montreal, Que.

GARLOCK

Wis. All parts may be readily taken apart for rapid cleaning. The stem is swiveled on the outside, eliminating the possibility of galling or scoring action. The sealing method is a small plastic ring.

Starter Has New Delay Mechanism

DEVELOPMENT of a new direct-current, definite-mechanical-time starter for general purpose constant speed motors where jogging is not required is announced by General Electric Co., Schenectady. Its rating is up to 5-horsepower, 115 volts, and 10-horsepower, 230 volts. The new starter consists of a solenoid-operated multi-finger contactor with an overload relay and employs a new time-delay escapement mechanism. In constant engagement with the operating shaft, this mechanism restrains the shaft in the starting motor but permits quick opening through the action of a positive overrunning clutch. A new isothermic overload relay makes possible improved overload protection, for it works on the heater and bimetallic strip principle and is easily set for either manual or automatic resetting after overload. The new starters are mounted on a molded plastic base. They may be applied to constant-speed motors up to 1800 revolutions per minute which do not require more than 150 per cent of full load torque to start nor longer than 10 seconds to attain full speeds.

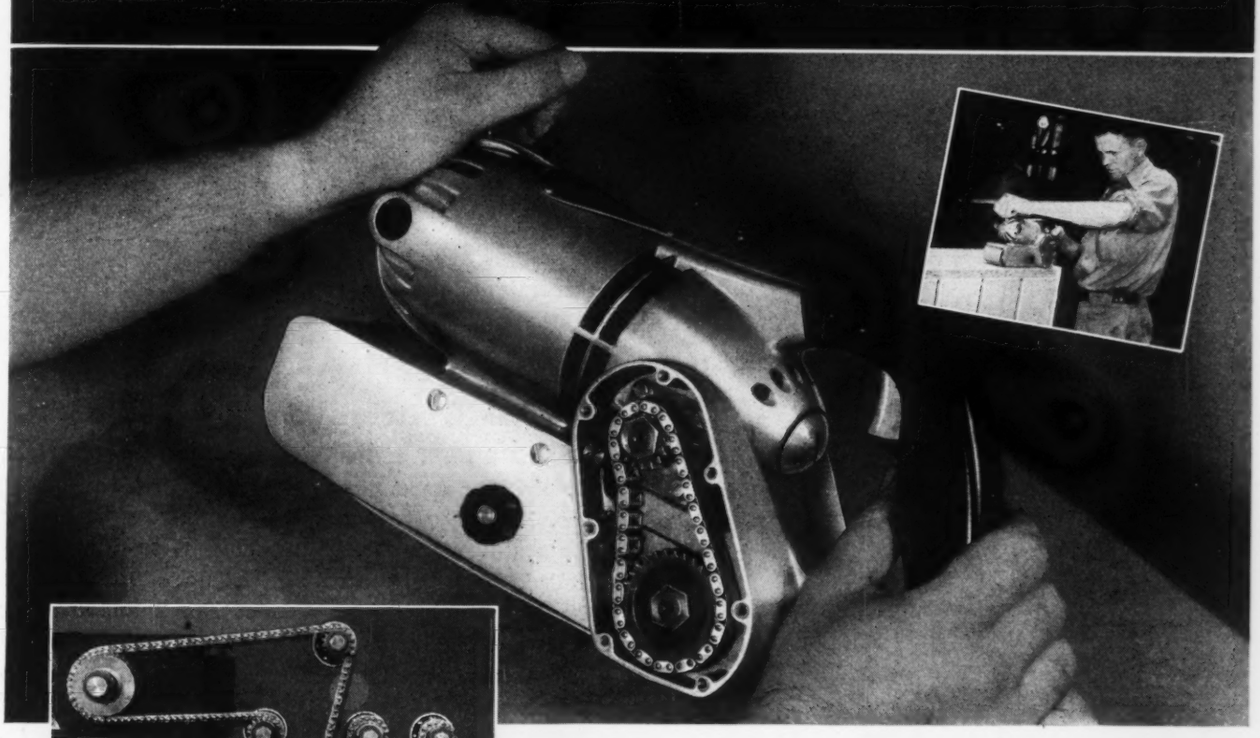


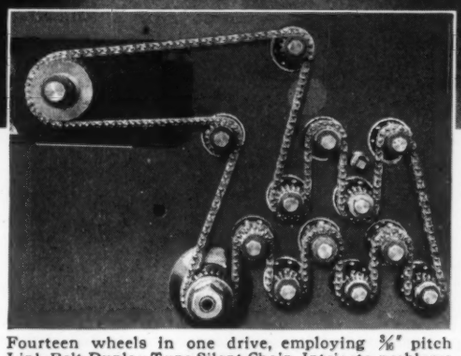
Starter consists of a solenoid-operated multi-finger contactor with an overload relay and employs a time-delay escapement mechanism

Large Motors Operate Quietly

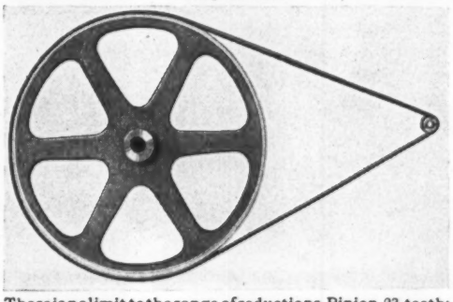
FEATURING quiet operation with minimum windage noise and radio frequency-tested insulation, a new design for 3600-revolutions per minute, 600 to 3000-horsepower induction motors is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. Bearings for the new unit are combination oil ring and forced-lubricated. Wide grooved rings provide lubrication for emergencies and during interruptions that might occur to the forced lubrication system. Particularly adaptable to centrifugal pump and compressor drives where reliability and low maintenance are important, these motors are built so they may

MAKE YOUR FRACTIONAL H. P. DRIVES
QUIET, POSITIVE, COMPACT, COOL-RUNNING

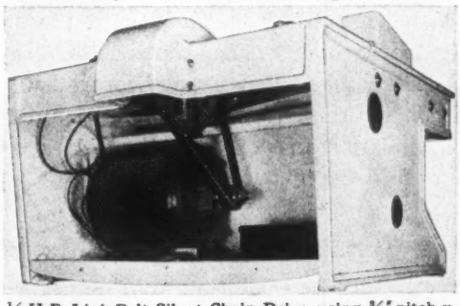




Fourteen wheels in one drive, employing 3/16" pitch Link-Belt Duplex Type Silent Chain. Intricate problems easily solved.



There is no limit to the range of reductions. Pinion, 23-teeth; driven wheel, 345-teeth as used on timing control drive.



1/4-H.P. Link-Belt Silent Chain Drive, using 3/16" pitch x 15/32" wide middle guide silent chain, 6 5/16-inch centers, operating retail bakery bread slicer; pinion, 21-teeth; driven wheel, 84-teeth.

USE LINK-BELT 3/16" SILVERSTREAK SILENT CHAIN

Mr. L. E. Parker, Chief Engineer of Skilsaw, Inc., Chicago, says:

> "A highly desirable feature in the design of our Zephyrplane 3" belt sander (illustrated above) is speed reduction by worm and worm wheel in connection with a 3/16" pitch x 15/32" wide Silverstreak silent chain drive. This drive was selected because of its compactness, smoothness of operation, efficiency and cool-running qualities, which are of vital importance in the design of portable electric tools."

Like Mr. Parker, many other machine designers have found this drive to be the ideal solution of problems calling for a positive, quiet, flexible drive for fractional horse power units. It is made in three types—middle guide, side flanged and duplex. The middle guide and side flanged chains are employed where all shafts are driven in one direction, and duplex where reverse direction is desired on some shaft or shafts, or where adjustment features are required.

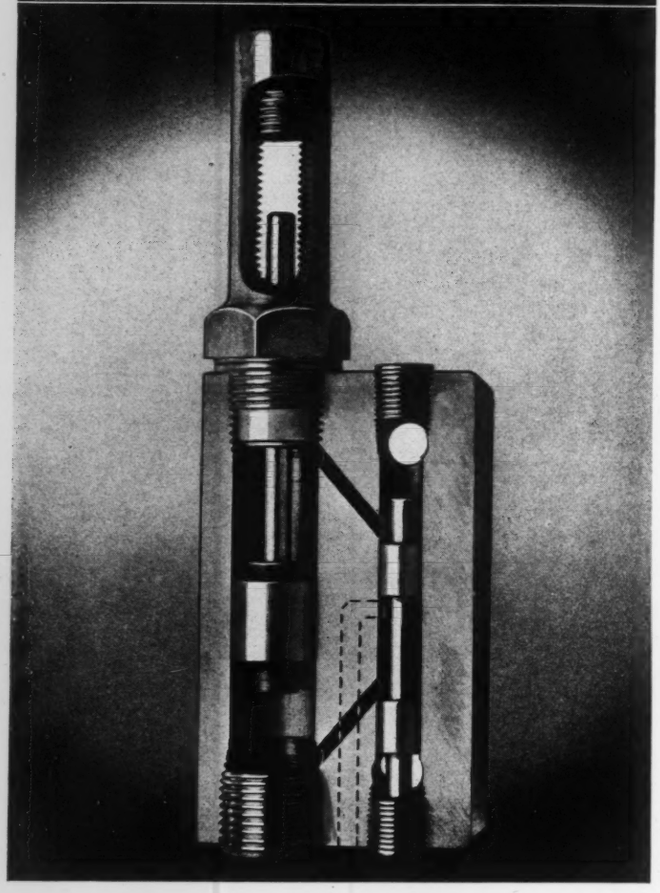
If you have a troublesome belt or gear drive, or desire assistance on a new design, submit full details to our nearest office, or direct to

LINK-BELT COMPANY 7868

519 N. Holmes Ave. Indianapolis, Indiana

Simplicity

...THE KEY TO DEPENDABLE LUBRICATION



The positive, piston-displacement Farval Valve, used to control the delivery of lubricant at each bearing, is extremely simple in construction and operation.

—It has but 2 moving parts
—contains no springs nor check valves
—is adjustable and indicating
—will handle either oil or grease
—is fully hydraulic in its operation

A simple, rugged Central Pumping Unit furnishes the high-pressure supply of lubricant to all Farval Valves, providing the complete lubrication of **all bearings in less than one minute.**

Farval Systems will **reduce labor of oiling • eliminate waste of lubricant • increase production • reduce repairs and maintenance • prolong the life of equipment.**

Farval thus quickly pays for itself and continues to earn at the same rapid rate throughout the years.

THE FARVAL CORPORATION, 3265 East 80th Street, Cleveland, Ohio

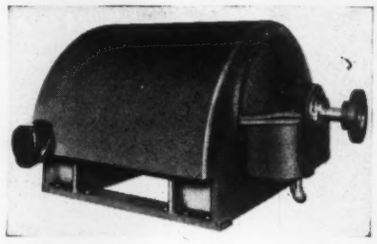
Affiliate of the Cleveland Worm & Gear Company . . . Automotive and Industrial Worm Gearing . . . In Canada: Peacock Brothers Limited

FARVAL

CENTRALIZED SYSTEM OF LUBRICATION

Special Delivery to Every Bearing

be started at either full or reduced voltage. They deliver normal starting torque with normal starting current. Dynamically balanced rotors, bearings per-

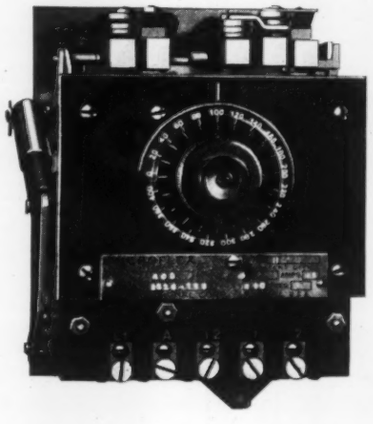


Particularly adaptable to centrifugal pump and compressor drives, heavy duty induction motors may be started either at full or reduced voltage

manently aligned, no moving contacts and directed ventilation for cool running make for less maintenance.

Two Switches Control Counter

OPERATION of the Microflex instantaneous reset counter announced by Eagle Signal Corp., Moline, Ill., is controlled entirely by two switches or contacts usually located on the device being controlled. The first control switch is closed to energize the clutch coil, closing contact No. 2 and opening contact No. 1, at the same time causing the clutch to engage connecting a solenoid-operated ratchet to the counting mechanism. Each closing of the second switch energizes the actuating coil of the solenoid-operated ratchet so that the ratchet mechanism is



Type of control switches — two entirely control operation — used with instantaneous reset counter depends on application

advanced one position. When the impulse switch has closed and opened for the number of times corresponding to the dial setting, contact No. 2 opens and contact No. 1 closes. The type of control switches used depends entirely upon the application of the counter. Standard Microflex counters have a counting range of 0 to 400 in steps of one.

Heavy Duty Pushbuttons on Market

A HEAVY duty pushbutton unit and improved design of wide flush plate mounting pushbutton are announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. The new apparatus consists of a

3,719,999 PERFECT TEETH... 20,000 Sets!

Hoist Manufacturer makes these Statements Regarding Steel Castings

"Strength concentrated where needed. Reduced thickness in parts involving no strains. Fewer parts — parts preassembled in castings. Less waste of material in finishing. Castings true, uniform, clean and smooth. Time saved in machining, drilling and finishing. Great weight saving without sacrifice of strength and ruggedness."

Over twenty thousand of these 5-ton hoists are in daily service. And of the 3,720,000 teeth in their gears, only *one* single tooth has ever been reported broken!

It's hard to imagine even a much more costly gear matching that perfect record.

In making this hoist of steel castings, 1690 pounds of weight are saved over the former design. 110 pounds does the work of 1800 pounds. And does it better!

The manufacturer challenges his customers to break any part of the hoist if rated capacity is not exceeded, and *they haven't done it yet*.

Your business will grow — no matter what you make — if you produce a better product at lower cost. Steel castings are making just that contribution to thousands of users. More and more steel castings are today proving their great value — over a million tons a year.

Discuss this important subject with your local foundry. Or write to Steel Founders' Society, 920 Midland Bldg., Cleveland, for money-saving suggestions.

IMPROVE YOUR PRODUCT WITH

STEEL CASTINGS

PUT
SAFETY
IN
YOUR PRODUCT
THIS EASY WAY!

SPECIFY

UNBRAKO

SELF-LOCKING
HOLLOW SET SCREWS
with the Knurled Points
wherever ordinary set
screws fail to hold

These screws will positively hold tight when set up in the usual way. No danger of vibration causing them to shake loose (as is possible with ordinary set screws) . . . no chance for a possible accident or breakdown of the machine . . . no need for continual check-ups. Play safe—specify "Unbrako" Self-Lockers.

The ingenious knurling offers no resistance either when setting up or unwinding. Both operations are made with the ordinary hex bar wrench and screws can be re-used indefinitely. Write for complete literature.

Fig. 1645 Pats. Pend.

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS

JENKINTOWN, PENNA.

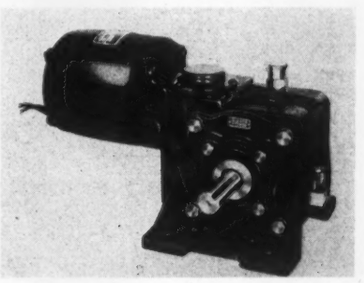
BOX 102

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

double pole, double throw pushbutton mounted in the same space as the ordinary single pole, double throw unit for use in all types of heavy duty push-button stations. It has four contacts, two on each side of the button. This unit is supplied with either standard or long button, and mounting bracket can be provided for ⅛-inch panel mounting if desired. The flush plate mounted stations have a wider plate for mounting in a machine.

Motor Runs at Very Low Speeds

DESIGNED primarily for very low speeds and high torques, a new speed reducer motor has been placed on the market by the Bodine Electric Co., 2264 West Ohio street, Chicago. Speeds may be as low as .6 revolutions per minute, torques as high as 350 inch-pounds. The motor itself develops from 1/50 to 1/20-horsepower, depending on the gear ratio used.



Speeds as low as .6 revolutions per minute and torques as high as 350 inch-pounds are possible with reducer motor

Gears and worms stand any loads imposed by the recommended motor. The gear housing holds an ample supply of oil and is provided with an oil gage. Positive lubrication is assured with both horizontal and vertical driveshaft mountings.

Timers Have Wide Adjustability

A NEW series of automatic reset timers is announced by the Paragon Electric Co., 39 West Van Buren street, Chicago. New features include a wide range of adjustability, instantaneous dial re-

Instantaneous dial reset, complete elimination of complicated clutch arrangements, wide range of adjustability feature automatic reset times with eight terminals

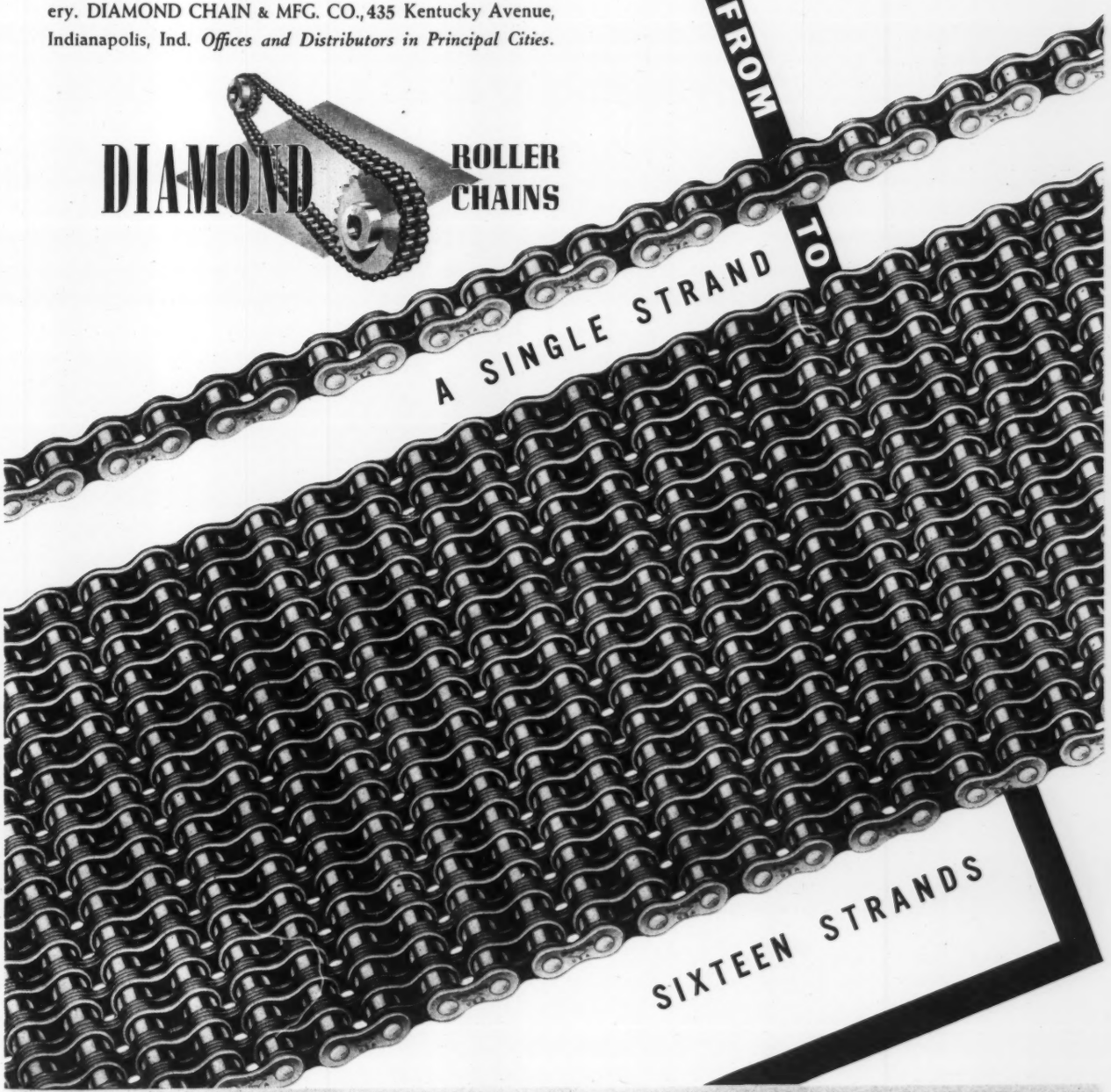
set and a complete elimination of delicate and complicated magnetic clutch arrangements. The pilot

IT'S THE DRIVE YOU USE THAT MAKES THE DIFFERENCE

From One Strand to 16 Strands

● To meet the many and varied power transmission requirements of industry—for slow, medium or high speeds—small or large capacities—fractional h.p. up to 1200 h.p.—Diamond Roller Chain Drives are available in single and multiple strands—from 1 to 16—in pitches from ⅜" to 2½"—and in any lengths. • Transmission efficiency remains constant and unusually high—over 98%—because with Diamond Drives "roll" replaces "slide," eliminating friction losses. • For motor drives and machinery applications, Diamond roller-bearing type Chain is found where the maximum in power transmission is desired—in the efficiently operated plants and on the finest machinery. DIAMOND CHAIN & MFG. CO., 435 Kentucky Avenue, Indianapolis, Ind. *Offices and Distributors in Principal Cities.*

ROLLER CHAIN DRIVES FOR FRACTIONAL OR THOUSAND HORSEPOWER



IT'S THE DRIVE YOU USE THAT MAKES THE DIFFERENCE

In Twin Disc MT Clutches, both "dry" and "in oil" types, the driven plates are of saw steel, heat treated and ground. They are driven by hardened keys, set in keyways in the clutch hub. ¶ This construction not only provides accurate location of the driving key but prevents the cutting of the driven plates into the driving key. Another detail that assures longer life and better performance of Twin Disc Machine Tool Clutches.

Ask our Engineering Department for detailed description of Twin Disc MT Clutches and find out why so many production men say "Twin Disc Machine Tool Clutches make a good machine better."

TWIN DISC CLUTCH CO. • 1325 RACINE ST. • RACINE, WIS.

control for these timers can be a momentary closing contact, a momentary opening contact or a constant closed contact. Eight terminals are furnished as standard. With time adjustments ranging from 1 to 14 seconds in ¼-second steps to 1 to 14 hours in 15 minute steps, ten standard models are available, built for connection to 115 or 230 volts, alternating current.

Mercury Switch Gives Delay-Action

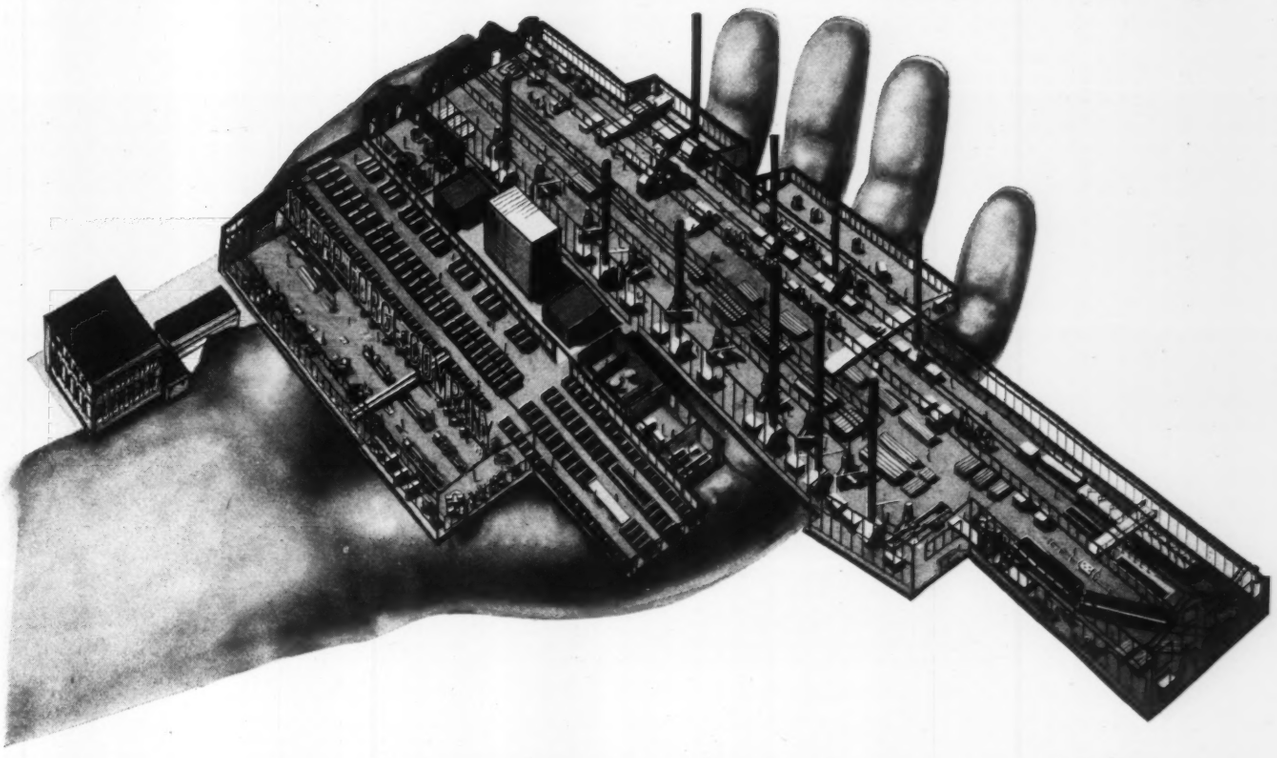
IN ADDITION to the standard line of Kon-nec-tor mercury switches, a new line of delayed-action mercury switches, available both in circuit-opening and circuit-closing types, has been announced by the Lamp department, General Electric Co., Hoboken, N. J. These units may be obtained with time-delay intervals of from ½ to 15 seconds for circuit-opening and from ½ to 10 seconds for circuit-closing. Simply and economically mounted, these new Kon-nec-tors may be operated either mechanically by means of a lever or cam action or electrically by means of a solenoid. The units have been designed with an electrical capacity ample for handling the average control circuit. By the restricted flow of mercury through a small orifice at the bottom of a metal chamber inside the switch, the delayed-action characteristic of these switches is obtained. Like the standard Kon-nec-tor switches, these new units are hermetically sealed in glass.

Available both in circuit-opening and circuit-closing types, a new line of delayed-action mercury switches is on market

Across-the-Line Starters Developed

A SMALL, inexpensive across-the-line starter for ratings up to two-horsepower, 220, 440 and 550 volts, two and three-phase, and equivalent ratings on single phase, is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. These units are used for across-the-line starting of squirrel cage induction motors and as primary switches for wound-rotor induction motors. They are also available in combination with motor circuit switches and circuit breakers

have some service!

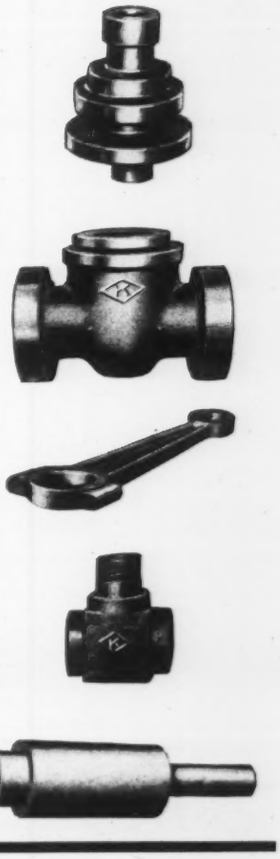


At Kropp, "the world's largest job forging shop," you get service that gives meaning to a much abused word. Here every customer is a "preferred customer".

This 100 year old organization has enjoyed a consistent growth based on the service it has rendered users of forgings. Down through the years we have had a single unity of purpose—making "forgings to user specifications." In dealing with Kropp, the "preliminaries" are eliminated—we know your wants and fill them promptly.

Three complete forging departments to serve you—upset, drop and steam hammer; complete facilities for heat treating, cleaning, pickling and a machine shop equipped for every phase of metal working. Also characteristic of Kropp service is the vast stock of specification steels carried on hand in our warehouse ready for forging.

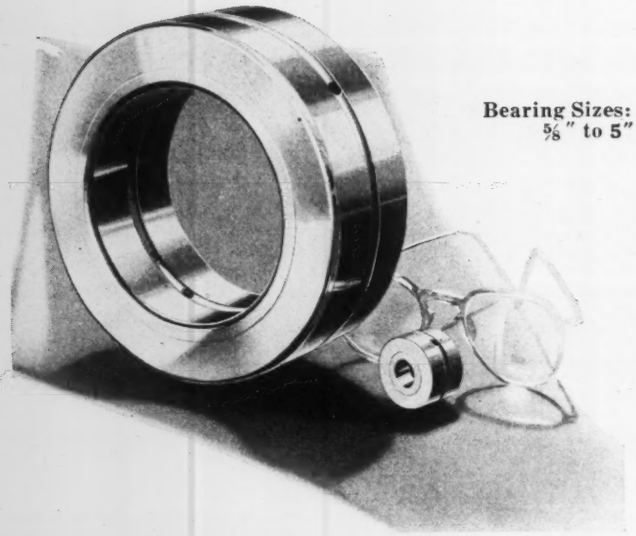
"Have Some Service" with your next requirements for forgings.



KROPP FORGE COMPANY

5307 W. Roosevelt Road, Chicago, Illinois

Representatives in Principal Cities

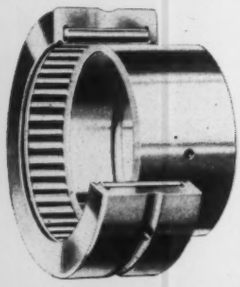


Bearing Sizes: 5/8" to 5"

"Solidend"
MULTIROL
BEARINGS

. . . made as ACCURATELY as the lenses in your glasses!

McGILL "Solidend" *MULTIROL* Bearings are machined with the same precision as the lenses of your glasses, and for the same reason . . . ACCURACY. Precision-machined bearings, such as the "Solidend" *MULTIROL*, provide greater load-carrying capacity, stability and longer trouble-free service. Their complete range of sizes—from 5/8" to 5"—makes them the logical choice over a wide range of applications. Roller-retaining shoulders are built integral with the outer race so that the bearing may be installed with, or without, the separable inner race, thereby eliminating the possibility of accidental dissembling.



The perfection of the McGILL "Solidend" *MULTIROL* Bearing is a great advance in needle roller-bearing construction. Greater load-carrying capacity, simplicity of construction, rigidity, and effective sealing are secured — all at a saving in cost to the user.

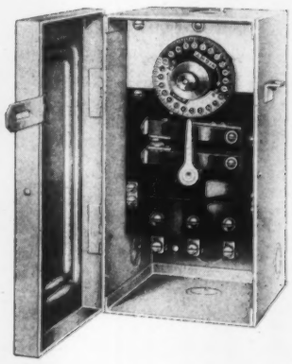
Write for New Solidend MULTIROL Bulletin

McGILL MANUFACTURING CO.
1450 N. Lafayette Street
VALPARAISO, INDIANA

in standard enclosures. Principal features include De-ion arc quenching and snap action bimetal disk overload relay.

Lubrication Sealed in Switch Motor

NEATLY styled steel cabinet of the electric time switch announced by Wadsworth Electric Mfg. Co. Inc., Covington, Ky., has concentric knockout in top, bottom, back and sides, and is finished in durable hard baked aluminum enamel, inside and out. Its synchronous motor, self-starting, has sealed-in lubrication, and pure silver contacts, on copper button, are securely mounted on plastic contact arms. Switch



Synchronous self-starting motor of electric time switch has sealed-in lubrication

action is new quick make-and-break, mechanically operated by the motor driven clock movement which produces a "wipe" action before contact is broken. Terminal block is equipped with solderless lugs, handy for quick secure wiring.

Engineering Dept. Equipment

Binder Attachment Tapes One Side

AN ATTACHMENT is announced for the Tough Edge binder made by the Vertex Co., 5 Great Jones street, New York, so that adhesive tapes of various widths may be applied along one side only of documents, tracings, cards, etc. It can be fastened to machines previously purchased. The binding of an edge may now be performed in two ways. The tape may be folded over the edge or it may be applied on one side only along the edge. Both operations may be performed simultaneously or successively.

Lettering Set, Table Announced

TWO new pieces of engineering department equipment— an accurate, economical lettering set and a portable folding drawing table—have been announced by Eugene Dietzgen Co., Chicago. An outstanding feature of the "Spee-Dee" lettering set is the fact it is possible with one single guide to produce eight different types of lettering simply by changing the setting of the tracer and of the pen arm.

photo courtesy Remington Rand Inc.

ADJUSTING ELECTRIC RAZORS

TYPICAL of the many applications of the STROBOTAC is Remington Rand's use for several . . . production adjustments of the cutting edge of Rand Close-Shavers. With the STROBOTAC the moving head of the razor is made to stand still so that the precise cutting-head adjustment can be made rapidly and accurately.

The uses for STROBOTACS throughout industry are limitless. If you have any machine or part which operates with reciprocating or rotating motion through definite cycles, the STROBOTAC can STOP motion even though the speeds are as high as 100,000 rpm. The exact operation can then be checked; or the STROBOTAC can be adjusted so that the machine or part appears to operate in s-l-o-w motion (as slow as a fraction of an rpm)!

STROBOTACS can be as necessary to you in designing, manufacturing, inspecting, operating, servicing and selling your product as they have been to hundreds of others. Let us show you how.

THE NEW TYPE 631-B STROBOTAC *has a drum-type illuminated scale at the top of the instrument, direct-reading in rpm from 600 to 14,400; a convenient trouble-proof switch on the front of the instrument selects the synchronizing source; the accuracy of the STROBOTAC has been increased to 1%, the weight decreased to 10 pounds. The price remains the same, only* **$95.00** *complete and ready for immediate operation.*

• ***WRITE FOR BULLETIN 505 FOR INFORMATION***

GENERAL RADIO COMPANY CAMBRIDGE MASSACHUSETTS

DESIGN
ON PARADE

Man in his quest for a better life invented machines. They have enabled him to raise his standard of living and have released him from the slavery of manual labor.

Today, as never before, machines hold the key to better economic and social conditions. The very future of the nation depends in the ultimate on the increase in mechanical efficiency. Without the constant influx of newly designed machines the parade of progress could not go on.

Every month *Machine Design* brings a preview of this pageant of technological development. It keeps its more than 30,000 readers informed and presents a record from which design engineers can obtain ideas that will help solve their problems. From thousands of plants and laboratories the latest information flows into our editorial offices to be interpreted and converted into print for the benefit of readers in over 7600 machinery manufacturing concerns.

Each lettering outfit has six different weights of pen points from extra light to extra bold, making 48 different weights and styles of type available. Letters are formed in one continuous movement without shifting the guide, because each character on the guide is complete and in alphabetical order. The "Handy" portable folding table can be lifted easily with one hand, folds and unfolds like a camp stool, and sets almost automatically to the right drawing position. A finger touch locks the board at the desired position. The table folds to 3 inches thick.

Meetings and Expositions

Nov. 10-11—

American Society of Refrigerating Engineers. Eastern air conditioning conference to be held at Lehigh university, Bethlehem, Pa. Prof. B. H. Jennings of Lehigh university is chairman of the conference committee.

Nov. 13-17—

American Petroleum institute. Annual meeting to be held at Stevens Hotel, Chicago. Lacey Walker, 50 West Fiftieth street, New York, is secretary.

Dec. 4-8—

American Society of Mechanical Engineers. Sixtieth annual meeting to be held at Bellevue-Stratford Hotel, Philadelphia. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

Dec. 4-9—

Seventeenth Exposition of Chemical Industries to be held at Grand Central Palace, New York. Charles F. Roth of International Exposition Co., at the same address, is in charge.

Dec. 9—

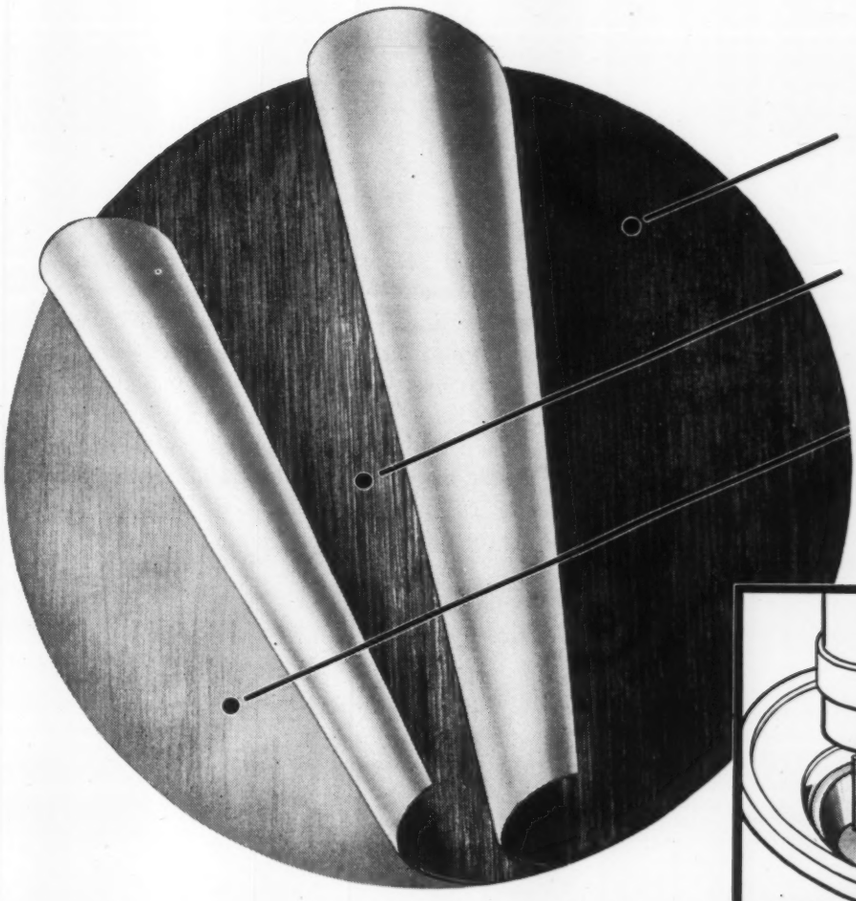
Eastern Photoelasticity conference. Tenth semiannual meeting to be held at Cambridge, Mass., under the auspices of the department of mechanical engineering, Massachusetts Institute of Technology. Additional information may be received from W. M. Murray, Room 1-321, Massachusetts Institute of Technology.

Dec. 12—

Motor and Equipment Manufacturers' association. Annual meeting to be held at Blackstone Hotel, Chicago. Additional information may be obtained from association headquarters.

Jan. 22-26—

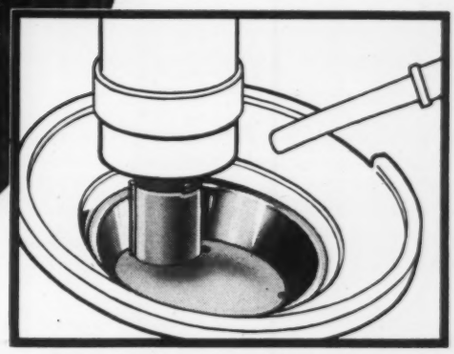
American Society of Heating and Ventilating Engineers. Sixth International Heating and Ventilating exposition and forty-sixth annual meeting of the society to be held at Lakeside Hall, Cleveland. Exposition will be under direction of Charles F. Roth, Manager, International Exposition Co., Grand Central Palace, New York.



ROUGH GROUND—Photomicrograph—25 diameters—showing amorphous film with roughness of approximately 15 micro-inches (millionths of an inch).

FINISH GROUND—More but finer scratches—surface finish of approximately 10 micro-inches composed of amorphous metal left by grinding operations—Photomicrograph of 25 diameters.

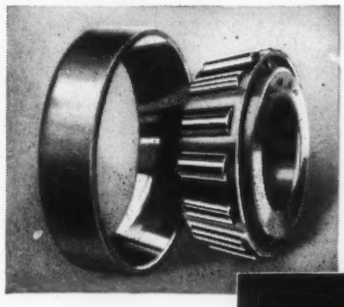
MICRO-HONED—25-diameter photomicrograph showing amorphous metal and grinding marks removed, baring hard surface and smoothness of approximately 3 micro-inches—scratches are below surface.



THIS "*FACE LIFTING*" OPERATION GIVES YOU BOWER Micro Honed BEARINGS

FOR years, engineers attempting to improve the ground finish of bearing surfaces have resorted to polishing, lapping and other methods that gave the appearance of a highly finished surface, but in reality destroyed mechanical accuracy.

To accomplish the improvement engineers had so long sought, the Bower Roller Bearing Company, after five years of development, perfected and adopted Bower Micro-Honing—an exclusive process that removes all grinding marks, clears off the objectionable amorphous film and goes still a step further by minutely refining the dimensions established in the ground finish.



Bower Micro-Honed Bearings, therefore, require no "running-in" or "wearing-in" periods, and no "final adjustments" are necessary.

Ask us for "How Bower Roller Bearings Undergo a 'Face-Lifting' Operation By Bower Micro-Honing," a descriptive folder that makes clear just what the Micro-Honing process is.

BOWER
ROLLER BEARING CO.
Detroit, Michigan

. . . CLEVELAND DRIVES MAKE MACHINES PAY BACK FASTER

Because:

NO MAINTENANCE OR REPLACEMENT COST

Blank cards—year after year in the files of companies operating thousands of Cleveland Worm Gear Speed Reducers—give forceful evidence that when properly applied by Design Engineers, Cleveland Drives *do* make machines pay back faster.

1—because they operate dependably throughout the machine lifetime with no replacement and with little or no expense for maintenance.

2—because Cleveland's sound engineering, precision manufacture and correct application safeguard profitable operation and eliminate shutdowns caused by failure of gearing.

The longer you know Clevelands, the greater your confidence in their ability to operate indefinitely for users of your machines. Cleveland Engineers will cooperate in adapting the correct types and sizes to the equipment *you* build.

Have you the Cleveland Worm Gear Book? 150 pages of invaluable data for daily reference and use by the Design Engineer. Your copy will be sent immediately upon request.

The Cleveland Worm & Gear Company, 3275 East 80th Street, Cleveland, Ohio.

Affiliate: The Farval Corporation, Cleveland, Manufacturers of Centralized Systems of Lubrication

CLEVELAND WORM GEAR *Speed Reducers*

Automatic Gearshift Tops 1940 Innovations

(*Continued from Page* 34)

force by about 75 per cent and consequently has eliminated much of the cause of wear on the torque ball and retainers, as well as reducing the passenger sense of vibration and instability. As a further precaution against scoring and wear, the malleable iron torque ball is tin plated and the stamped steel inner and outer retainers copper plated on their contacting surfaces.

Rear shock absorbers on the same car have been relocated on the rear brake backing plates rather than on the frame. The new location for these cast iron parallel cylinder units places them where tests have shown them to be most effective, as far back from the

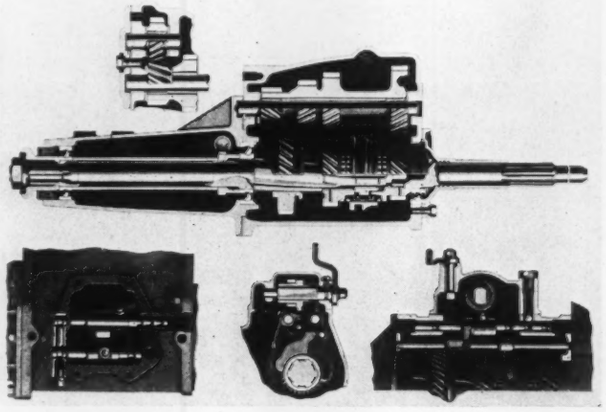


Fig. 9—Comparison of torque tube and rear spring suspension system on 1939 and 1940 Buick models

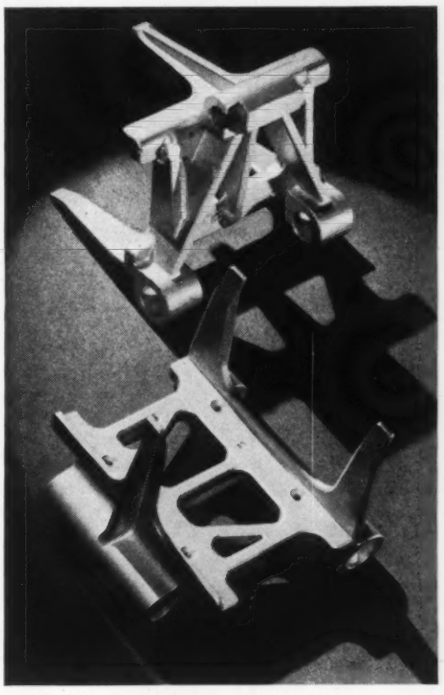
vertical pivoting point of the axle and as far out from the rotating center of the axle as is possible.

Simplified, ruggedly built starting motor switch, vacuum controlled, has been developed for 1940 Buick models, operation of which is shown diagrammatically in *Fig.* 7. Main feature of the switch is that it precludes clashing of starter gears after the instant the engine revolves under its own power, by virtue of the fact the circuit is opened with extremely low vacuum. Contacts in the switch for closing the circuit are made by springs on a rotor. The contact thereon is caused by a wiping action switch which produces a larger area of contacts than previously. Circuit is opened by a plastic slide moved by the diaphragm. This slide is the only part operated by the diaphragm and consequently the locking function occurs with a minimum vacuum and with practically no friction. *Fig.* 7 shows the switch in cranking position with the throttle partly open. In running position with the throttle partly open, the diaphragm rises and compresses the diaphragm return spring, simultaneously pulling the plastic lockout slide up. The tip of the rotor contact

MAZLO
Reg.U.S.Pat.Off.

MAGNESIUM ALLOYS

THE LAST WORD IN LIGHTNESS



Light weight Magnesium conveyor links speed up starting and stopping.

MAZLO Magnesium die castings make these binoculars much easier to use.

MAZLO manufacturing services include facilities for production of all types of Magnesium castings, in any quantity; sand, permanent mold and die castings.

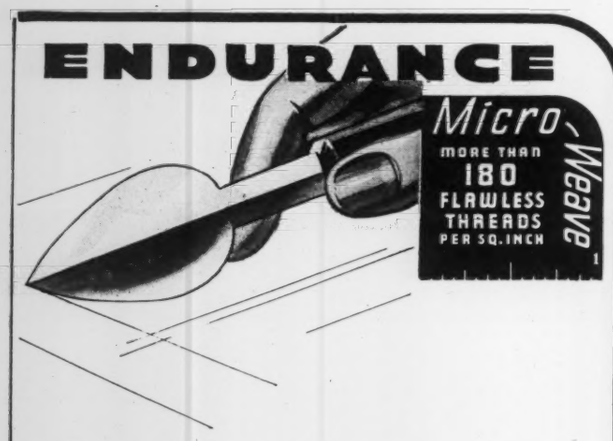
Here you see two sets of MAZLO Magnesium die castings. Note the fine finish on these intricate pieces. Dimensions are accurate. Very little machining is required before they're ready for assembly.

MAZLO Magnesium Alloys provide a range of mechanical and fabricating characteristics which enable you to profit fully from the use of this lightest of commercial metals (one-fourth the weight of iron). They make it economical for you to go *very* light.

MAZLO engineers have been dealing for years with weight reduction problems. Why not consult them on the design and fabrication of your products? *Sales Agent:* Aluminum Company of America, 1703 Gulf Bldg., Pittsburgh, Pa.

MAZLO

AMERICAN MAGNESIUM CORPORATION



Micro-Weave

ALL-AMERICAN

TRACING CLOTH

Highly transparent, finely, flawlessly woven, strong yet thin, Microweave Tracing Cloth endures under exacting technical and practical tests—such as the erasure test which specifies, in brief:

"Wipe with fuller's earth. Draw lines of various widths with waterproof ink. Erase with steel, then Van Dyke No. 6500 type, finishing with Ruby type eraser. Draw lines perpendicular to first erasure and repeat erasure process. Draw lines diagonal to former erasures. These lines shall show no signs of spreading or feathering."

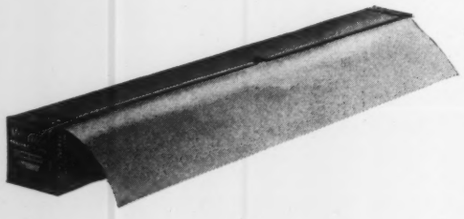
An example of the quality of this all-American tracing cloth that meets all recognized standards. Send for a generous sample and experience its superiority.

Companion Products: Royal Blue Print Cloth and Photo-Cloth

THE HOLLISTON MILLS, INC.

NORWOOD, MASSACHUSETTS

Boston · New York · Philadelphia · Chicago · St. Louis



Fresh, clean and smooth—packed in a handy "Dispenser Box" with brackets for attaching to wall or desk, if desired.

and lockout lever is pushed away in such fashion that the level no longer makes contact with the rotor and the circuit is broken. When the motor stops the spring and diaphragm fall back and the rotor reverses in a clockwise direction.

Direction signal lights, first introduced by Buick last year, have been installed by Hudson and Cadillac-La Salle. These systems are arranged to flash forward parking light and tail light on one side of the car to signal a turn to be made in that direction. Control is through a lever placed just under the steering wheel. Interesting departure on the new Buick system is that in addition to the outside lights flashing, small green indicator lights on the dash also glow to show the driver his signal system is in operation. Further to prevent the danger of misunderstanding, the direction signal lights are turned off automatically at the completion of a turn by a cam arrangement on the steering column, loosely mounted so that should the signal switch jam it would not interfere with steering. *Fig.* 4 shows how the system is wired.

Practically all cars now have gearshifts mounted

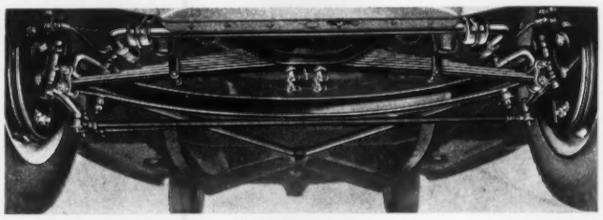


Fig. 10—Softer transverse leaf springs used in conjunction with a torsion bar ride stabilizer and self-sealing shock absorbers are featured on deluxe Ford and Mercury models

on the steering column and all, with the exception of Chevrolet which incorporates a vacuum booster, are actuated manually. Designers have worked toward making these systems easier to operate and less liable to get out of adjustment. Rod linkages to the transmission case have supplanted cables previously used. Rubber and compressed fabric bushings have replaced metal to metal contact, as in *Fig.* 3, eliminating the need for lubrication and assuring quiet operation. Further redesign may be required on some of these gearshifts, however, for reports from the field indicate that occasional difficulties are experienced with fabric bushings swelling and developing squeaks which cannot be overcome by oiling.

Composition or compressed fabric bushings also have replaced threaded steel bushings on the inner ends of the lower support arms of the Buick front suspension system on four series of cars, eliminating the need for lubrication and seals at these points. Last year rubber bushings were tried at these joints but because of their resiliency found to interfere with the action of the front chassis springs. At the outer ends of these support arms, neoprene seals are used, encircling the pivot pins between the arms and the knuckle sup-

Streamlining has invaded the machine shop and the home. The modern trend is toward neater, more compact machinery. Sometimes the motor presents a problem in the streamlining of machinery. Sometimes the Wagner motors are used, for Wagner motors are designed to harmonize with the most modern machinery and appliances. No longer must the motor be an unsightly appendage on an otherwise modern piece of equipment. Wagner motors are designed for compactness and neat appearance. They seemingly become an integral part of the equipment they operate.

Appearance is only one reason why more and more manufacturers are selecting Wagner motors for their modernized equipment. There are *other* reasons, too. Wagner motors are sturdy and reliable. Their record for performance and dependability is your assurance that they will give the kind of service you want your equipment to give. Wagner motors are so diversified in types and ratings that you can select the motor that exactly meets the electrical and mechanical requirements of each particular machine.

Wagner maintains 25 sales and service branches throughout the United States. Each branch carries a stock of motors ready for immediate shipment.

Modern design . . . Reliable performance . . . Diversified types . . . Convenient locations . . . four important considerations in the selection of motors for your equipment.

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

MOTORS • TRANSFORMERS • FANS • BRAKES

WRITE FOR BULLETINS 177, 179 and 182

These bulletins are fully illustrated, showing cutaway views, performance curves, etc. **Write for Your Free Copies Today**

M 39-26

HERE'S HOW - - - -

You Can Reduce Flange Sizes By Using KNURLED

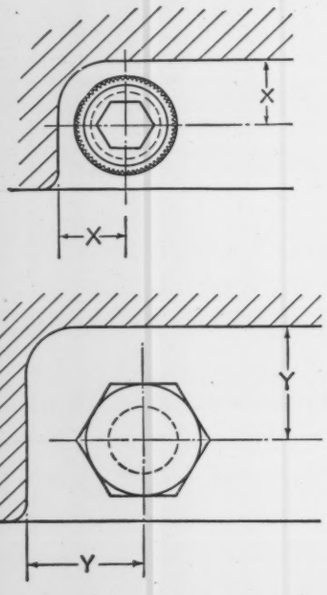
UNBRAKO

SOCKET HEAD CAP SCREWS

The plan views shown below clearly demonstrate how really remarkable savings in flange sizes can be made through the use of Knurled "Unbrakos" instead of ordinary hex head screws. The "Unbrako" snuggles right into the corner . . . there's no need to allow that extra space to get in a wrench. The savings in weight and cost of materials, as well as the improvement in design is obvious. Also, you get increased holding power due to the screw head being brought closer to the joint. The knurled head of the "Unbrako" not only facilitates the work of putting it in place but further dresses up the finished product.

Send for a copy of our "Unbrako" Catalog which gives diagrammatic views of this space saving as well as lots of other information.

COMPARE THESE DRAWINGS



In the upper drawing, see how the Knurled "Unbrako" snuggles right into the corner. Compare that with the great amount of otherwise wasted space needed for the hex head and wrench.

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS — JENKINTOWN, PENNA. BOX 102 — BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

port. They help to retain lubricant and also keep out mud and water from the threaded bearing surfaces.

Hood locks have made their appearance on several cars using the alligator-type hood. Hudson continues this feature from last year. Studebaker has mounted the hood latch on the dash, and in operation a system of rods and crank releases the spring catch holding the hood closed at the front. Olds has adopted a similar system of hood latching. Chevrolet this year has a dual control on its front-opening alligator hood. A wire cable from the dash releases a spring catch at the front, permitting the hood to raise about 1 inch. Then a second catch under the hood is released manually by inserting two fingers and pressing upward, permitting the hood to clear the latching mechanism which is made up of a number of die castings. Springs on the support arms at the rear serve to counterbalance the hood, allowing it to be easily raised.

Other Refinements Improve Performance

A number of other design improvements in 1940 models can be cited briefly. In one car a section of flexible hose has been placed in the copper fuel tank-to-fuel pump line to dampen any vibration emanating from the fuel pump and to prevent it from being "telegraphed" to the frame and body. The flexible section is of neoprene, wound with piano wire and covered with canvas.

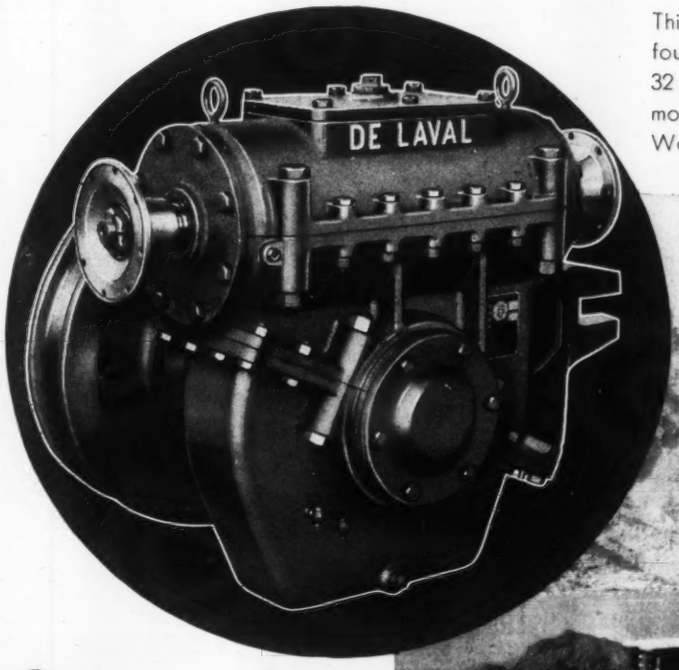
Automatic choke "stove" on Buick engines is much faster acting by virtue of an Inconel tube built through the exhaust manifold at the exhaust manifold valve inlet. Being directly in the flame path, the stove heats immediately and provides a shorter warm-up period.

Several cars have adopted terne plate (lead-coated steel) as a material for exhaust mufflers. Highly resistant to heat and corrosive effects of salt and other chemicals placed on roads during winter months, terne plate should help to overcome complaints on short life of mufflers.

Hudson is now silver plating all electrical terminals to avoid voltage losses and give longer life through avoidance of oxidation.

New tappets have been designed for Chevrolet engines, permitting the shortening of pushrods about 2 inches. Instead of the pushrod riding on the inside lower surface of the hollow cast iron tappet cylinder, a so-called "flower pot" or screw machine piece with hemispherical seat for the pushrod is copper brazed to the cast iron tappet body and simultaneously hardened by the electric induction heating method.

While changes in 1940 models are perhaps not as radical as was the case a year ago, added comfort and ease of operation have been given paramount attention. As always, cars are being made more durable and satisfactory, so that with more or less stationary prices the value per dollar continues to rise with every design development reaching a successful conclusion.



This 10 ton ore bridge is propelled along the water front by four 33 h.p. motors driving the individual traction wheels through 32 De Laval 40 ratio Worm Gears. There are also two 8½ h.p. motors operating clamping drives through De Laval 24½ ratio Worm Gears.

Do it with
DE LAVAL WORM GEARS

THE design of heavy machinery is generally facilitated, and its reliability in operation enhanced, by the use of DE LAVAL WORM SPEED REDUCING GEARS, as in this ore bridge designed and built by the Dravo Corporation, of Pittsburgh, for a large steel company.

Other notable applications which have been made of De Laval Worm Gears in the construction of blast furnace and steel works equipment, are in furnace door lifters, catcher tables for three-high mills, plate shears, up-cut bloom shears, billet pushers, heavy duty roll lathes, steel wire fabricating machines, piler tables, draw benches, crane trolleys, coal crushers, fan drives, manipulator tables, straighteners, edging rolls, screw-downs, cooling table transfers, roll grinders, ingot buggy drives, hot beds, etc.

• • •

Engineering data is available on the application of De Laval worms and worm wheels, or of complete De Laval speed reducers, including bearings and casings, to a great variety of drives, and our worm gear specialists will, if desired, assist in obtaining the best solution of your transmission problems. By using De Laval worm gears you insure high reliability and efficiency and economical construction.

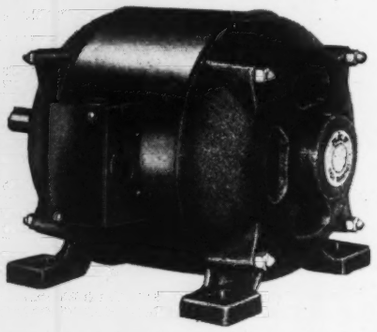
1101

DE LAVAL *Steam Turbine Co.*
TRENTON, N.J.

MANUFACTURERS OF STEAM TURBINES; PUMPS – CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT; CENTRIFUGAL BLOWERS AND COMPRESSORS; WORM GEARS; HELICAL GEARS; HYDRAULIC TURBINES AND FLEXIBLE COUPLINGS • • • SOLE LICENSEE OF THE BAUER-WACH EXHAUST TURBINE SYSTEM

MORE PERFORMANCE THAN YOU EXPECT...

K-C MOTORS



Because K-C motors are trimmed down to the barest essentials, they don't look as powerful as they really are. These fractional horsepower motors are made small, sturdy and compact so machine designers can use them to incorporate refinement and efficiency into their plans. K-C motors include single and three phase, capacitor start, heavy duty power motors. Also single and two speed fan motors.

★

KINGSTON-CONLEY
ELECTRIC COMPANY
North Plainfield, New Jersey

WRITE FOR GENERAL PUMP CATALOG

TUTHILL *Pump Company*
941 EAST 95TH STREET, CHICAGO, ILL.

DEPENDABILITY PROVEN BY HUNDREDS OF THOUSANDS IN THE FIELD

MANUFACTURERS' *publications*

ALLOYS (EXPANDING)—Included in the Cerromatrix manual just published by Cerro de Pasco Copper Corp., New York, are several pages devoted specifically to the application of this lead-tin-bismuth-antimony alloy in the anchoring of stationary machine parts, by which machining of expensive drive fits is often eliminated. The book, profusely illustrated with photographs and line drawings, discusses in detail countless other uses for the material, which expands upon cooling.

BEARINGS (BALL)—Marlin-Rockwell Corp., Jamestown, N. Y., has issued bulletin No. 27 of its series "Ball Bearing Practices for the Shop Man," which despite its title, has plenty of information for the designer. This particular bulletin deals with locknuts and lock washers for ball bearings, and discusses their characteristics and dimensions. A chart lists locknut and lock washer numbers beside nominal shaft diameters, nut dimensions, and shaft dimensions.

BEARINGS (OILLESS)—Presenting the history of oilless bronze bearings, and showing the various types manufactured and their versatility, a new catalog has been issued by the R. W. Rhoades Metaline Co., Long Island City, N. Y. Generously illustrated, the catalog includes tables of sizes and specifications, as well as instructions for application.

BEARINGS (ROLLER)—The staggered and meshed roller arrangement of Orange bearings is explained in a new engineering data book issued by Orange Roller Bearing Co. Inc., Orange, N. J. Pages of tables list dimensions, capacities, shaft tolerances and fits for these bearings. Latter part of the book is devoted to line drawings of typical applications, and mention is made of standard heavy duty bearings also made by the company.

CAST PARTS—Emphasis on machine tool castings has been laid by Meehanite Research institute, Pittsburgh, in its new bulletin No. 9. In addition to information in the form of charts and pictures on the engineering properties of this metal, the latter part of the bulletin contains numerous illustrations showing applications of Meehanite castings to machine tools.

CLUTCHES—Standard types of friction clutches with metal to metal frictions as well as the Super-Johnson type with Raybestos faced expansion ring which operates dry when necessary, are described in the new catalog of The Carlyle Johnson Machine Co., Manchester, Conn. Prices and dimensions are listed.

CONTACTS—Silver, precious metal and alloy contacts are described and illustrated in bulletin No. C902 just issued by Fansteel Metallurgical Corp., North Chi-

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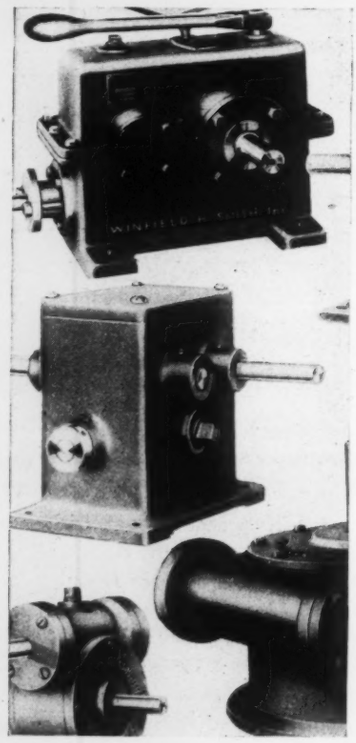

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cago, Ill. Compositions of the various types are given and drawings show shapes of many contacts. Information is supplied on selection of contacts.

CONTROLS (ELECTRICAL)—A former review appearing under this heading contained a typographical error and should have read as follows. A booklet, "Dust the Destroyer," has been issued by Cutler-Hammer Inc., Milwaukee, setting forth the advantages of the company's vertical contacts in its controls. Latter half of the booklet is devoted to an illustrated discussion of the company's line of controls and their applications.

CONTROLS (ELECTRICAL) — Safety starting switches of all types are shown in catalog No. 8, published by the Arrow-Hart & Hegeman Electric Co., Hartford, Conn. Under amperages, switches are listed by catalog numbers, horsepowers, poles, and weights. Circuit breakers, alternating current magnetic starters, contactors and pushbutton stations are included in the catalog. Prices are appended.

CONTROLS (ELECTRICAL) — The Neotron weld timer, operating on the electronic principle for small or large capacity welders, is described in an illustrated bulletin published by the Electric Controller & Mfg. Co., 2706 East Seventy-ninth street, Cleveland. Uses, dimensions, characteristics are listed.

CONTROLS (ELECTRICAL)—Leaflets and booklets in color issued recently by General Electric Co., Schenectady, include the following: GEA-3043, limit switches; GEA-821G, pressure and vacuum switches, diaphragm type, alternating or direct current; GEA-3281, field discharge switches; GEA-2230A, rotating cam switches for universal use; and GEA-2634, a booklet discussing how to select protective devices for low voltage power circuits.

CONTROLS (ELECTRICAL)—Catalog No. 9 issued by Roller-Smith Co., Bethlehem, Pa., describes various types of instrument and control switches. Prices and diagrams of connections are given.

CONTROLS (ELECTRICAL)—Designed for across-the-line starting of squirrel-cage induction motors and as primary switches for wound-rotor induction motors, sizes 0 and 1 De-ion nonreversing linestarters are described in a new leaflet published by the Westinghouse Electric & Mfg. Co., East Pittsburgh. The units have typical applications on pumps, fans, machine tools.

COUPLINGS (FLEXIBLE)—Fractional horsepower couplings for use with motors of 1-horsepower and less on direct drive applications are covered in bulletin 200 published by Lord Mfg. Co., Erie, Pa. Six particular advantages relating to vibration absorption, parallel misalignment, angular misalignment, noise reduction, simplicity, and bonding are discussed briefly. Specifications and dimensions are listed.

DRIVES (V-BELT)—Enlarged to the size of current picture magazines, Texrope Topics, published by the Allis-Chalmers Mfg. Co., Milwaukee, has been radically

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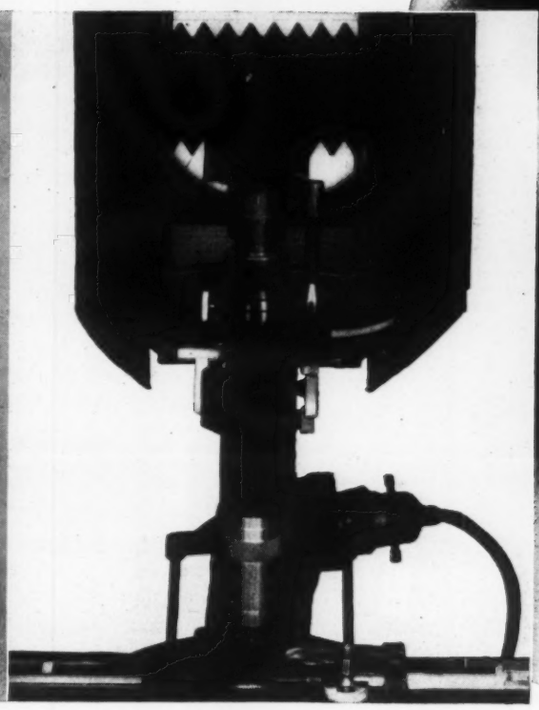

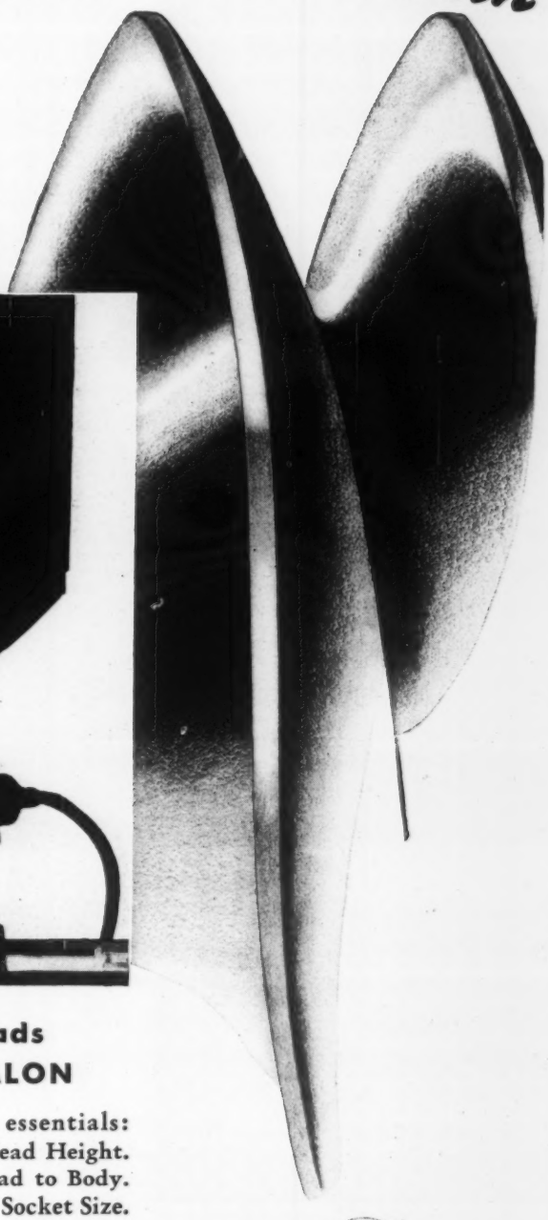

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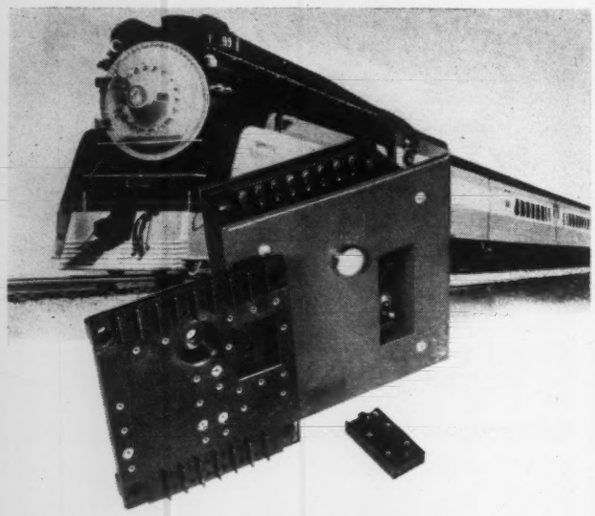

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changed in appearance and content. Illustrations are larger, text is more entertaining and useful. As before, it covers ideas and new industrial developments and trends in the power transmission field.

ELECTRICAL EQUIPMENT — American Phenolic Corp., 1250 West Van Buren street, Chicago, has published condensed bulletin 59-J, describing many electrical fixtures, including receptacles and plugs molded from high dielectric plastic. Contacts are phosphor bronze. A unique construction provides a new method of mounting for high speed production.

FASTENINGS—Explaining graphically the Elastic Stop principle, whereby the nut is locked to the bolt through the action of a resilient nonmetallic collar which eliminates thread play between nut and bolt, the 1939 catalog and data book of Elastic Stop Nut Corp., 1015 Newark avenue, Elizabeth, N. J., has been issued. This 56-page book also contains a complete listing of nuts available.

FASTENINGS—"Unbrako" screws of various kinds are described in an illustrated catalog just issued by Standard Pressed Steel Co., Jenkintown, Pa. Particularly helpful are the engineering explanations of why these screws are easily applied and why they hold. Various other "Unbrako" products are mentioned and list prices for screws are given.

FELT—A revised form of felt application chart has been prepared by Booth Felt Co. Inc., 434 Nineteenth street, Brooklyn, N. Y., utilizing the combined felt chart-and-sample idea of attaching actual felt samples under the various S.A.E. numbers. The chart also lists a wide variety of purposes for each type of felt shown.

FILTERS—Offering 99 per cent air filtering efficiency along with effective silencing characteristics, Filter-Silencers are described by Air-Maze Corp., 5200 Harvard avenue, Cleveland, in an illustrated bulletin just issued. Capacities, dimensions and prices are given.

FINISHES—Kemick, a chemical rust-preventing paint for metal surfaces subjected to high temperatures, is described in a new bulletin issued by American Chemical Paint Co., Ambler, Pa. Kemick is said to stay on even though the metal gets red hot, the heat changing Kemick into materials which become integral with the metal and thus prevent rust.

GEARMOTORS—Efficient utilization of cubical space in sizes RWC-2505 and RWC-2510 small gearmotors is emphasized by The Holtzer-Cabot Electric Co., Boston, in bulletin 1480-01 discussing these drives. Motor is the single value capacitor type, and spur gear train is integral with the motor. RWC-2505 has standard output speeds of 1, 2 or 60 revolutions per minute; RWC-2510 has output speed of 60 revolutions, but output torque is greater.

INSTRUMENTS—The model 1001 Flame-Otrol combustion safeguard is described in bulletin 1001-1 published by Wheelco Instruments Co., 1929 South Halsted

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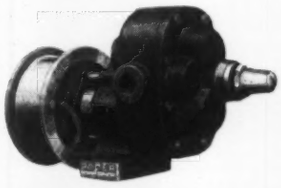

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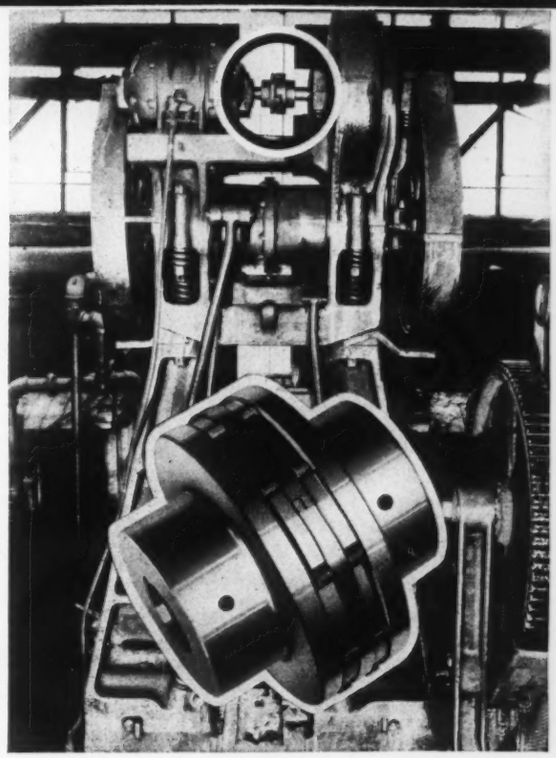

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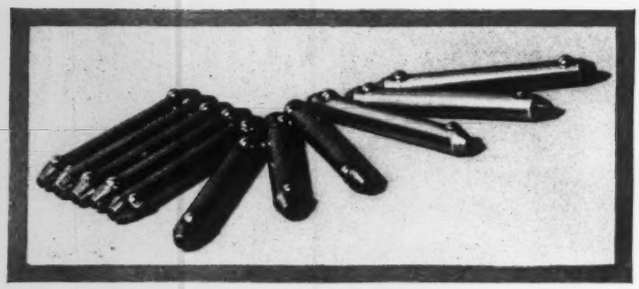

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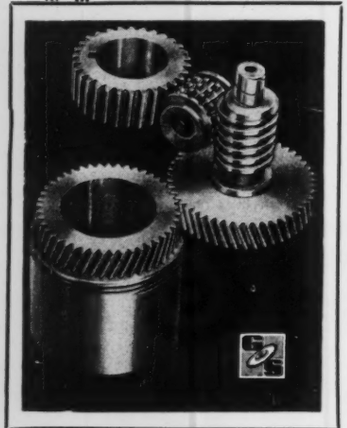

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street, Chicago. Specifications and features are outlined, and a typical circuit incorporating the Flame-Otrol is shown.

LUBRICATION—Latest issue of the "Lubriplate Film," issued by Fiske Brothers Refining Co., Newark, N. J., discusses the use of Lubriplate lubricants in the cement and related industries. For use in machines utilized in the cement industry, recommendations of these lubricants are given by numbers.

MOTORS—Presenting a wide range of facts to help specifiers in estimating costs, types and sizes of drive equipment and motors for use under various conditions, a new 28-page booklet, B-6029, has been issued by Allis-Chalmers Mfg. Co., Milwaukee, covering Lo-Maintenance motors and Texrope drives. The booklet is in form for easy reference.

MOTORS—Theme of an illustrated folder issued by Century Electric Co., St. Louis, is the starting and operating advantages of Century repulsion start induction single phase motor. Single phase motors as a type are also discussed, including their comparative starting torques and starting currents. Finally, Century motors are pictorially taken apart and examined.

MOTORS—Recent publications of General Electric Co., Schenectady, include the following, with their subjects: GEA-1276D, split phase motors, type KH, 1/60 to 1/3-horsepower; GEA-1807B, squirrel cage induction motors, types KT, FT, and FTR, 100 to 1500-horsepower; GEA-1698A, wound-rotor induction motors, types M and MT, 1-horsepower and larger; and GEA-98B, single phase, repulsion, brush-shifting motor, type RB, ¼ to 3-horsepower.

MOTORS—Describing shaded pole and companion alternating and direct current series wound motors of 1/125 to 1/30-horsepower, a new booklet, F-8488, has been issued by Westinghouse Electric & Mfg. Co. Rotor and shaft are the only moving parts on these motors, which give speed reduction up to 50 per cent of load speed on fan, unit heater and blower applications.

PUMPS—Covering industrial applications, bulletin 260-B11D has been issued by the Turbine Pump division, Roots-Connersville Blower Corp., Connersville, Ind. Design features are covered in detail, including cutaway views, diagrams of internal seals, typical performance curves and standard specifications. Installation photographs are included.

TRANSFORMERS—Variac transformers for voltage control are described in an illustrated folder in color issued by General Radio Co., Cambridge, Mass.

TRANSMISSIONS (VARIABLE SPEED)—An elaborate catalog, No. G-397, in color has been published by Reeves Pulley Co., Columbus, Ind. Separate discussion is devoted to variable speed transmissions, vari-speed motor pulleys, and vari-speed motodrives. Illustrations show applications, operating principles. Other information in the book comprises virtually a complete manual on these transmissions. List prices and dimensions are given.

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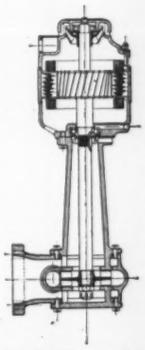

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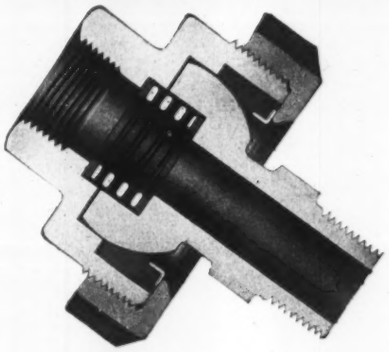

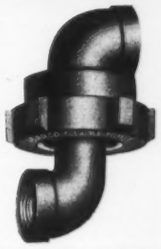

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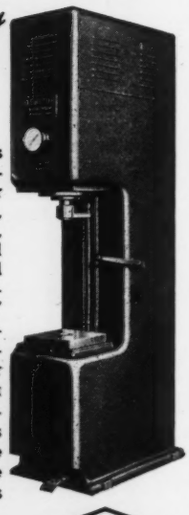

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Business and Sales Briefs

MANUFACTURING licenses have been granted by Meehanite Metal Corp., Pittsburgh, to the Vancouver Engineering Works Ltd., Vancouver, B. C., and to the Washington Machinery & Supply Co., Spokane, Wash.

♦

Associated with the bearing field for the past fifteen years, most of which has been spent with Bantam Bearings Corp., South Bend, Ind., R. B. Nichols has been elected secretary of the company. He will also continue as sales manager for the company.

♦

C. E. H. Palmer, connected with the Newark, N. J., office of General Electric Co., has been transferred to the New Haven, Conn., office of the company as manager.

♦

The following appointments have been made by T. B. Wood's Sons Co.; Louisville Mill Supply Co., 1012 East Main street, Louisville, Ky.; M. D. Larkin Co., 115 East Third street, Dayton, O.; and Henry D. Clark, with offices at 94 Plane street, Newark, N. J.

♦

Address of the various units of Union Carbide & Carbon Corp. has been changed to the Carbide and Carbon building, 30 East Forty-second street, New York.

♦

Nitralloy Corp. recently announced the licensing of Metallurgical Laboratories Inc., Philadelphia; Ontario Research Foundation, Toronto, Canada; and Pittsburgh Commercial Heat Treating Co., Pittsburgh, to use its patented nitriding process.

♦

Formerly of the Chicago office of Cutler-Hammer Inc., H. E. Ankeney has been placed in charge of the Indianapolis territory, operating under the supervision of the Chicago office. The Indianapolis office is located at 307 North Pennsylvania avenue.

♦

A license has been granted to Allegheny Ludlum Steel Corp., by the Inland Steel Co., Chicago, to produce lead-bearing stainless and high-alloy steels, and the right to sub-license other producers in the stainless field. This license is exclusive with the exception of Carpenter Steel Co.

♦

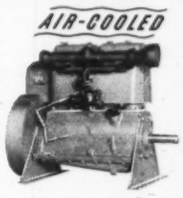
New laboratories have been completed by Summerill Tubing Co., Bridgeport, Pa., to aid manufacturers in

in EXTREME HEAT

or BITTER COLD

Your Equipment is Safe with WISCONSIN Air Cooled Power . . .

Ultra-modern are these adzing machines and subject to terrific punishment in all kinds of weather. They are equipped with WISCONSIN 4 cylinder heavy-duty air-cooled engines.
Further Details on Request



Single Cyl. Models - 1 to 8 H.P.
Four Cyl. Models - 8 to 35 H.P.

HEAVY DUTY AIR COOLED ENGINES

WISCONSIN
MOTOR CORPORATION
MILWAUKEE • WISCONSIN

DID YOU TRY RAYMOND FOR THOSE SPRINGS ?

Designing Springs for high temperatures, high speeds, to meet corrosive conditions . . . . these are jobs for the experienced springmaker. If you have problems in spring design, RAYMOND has the experience and engineering brains to solve them

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WIRE FORMS
STAMPINGS

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W. H. Slaughter,
419 Oakdale St., S. E.
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A. O. Gates
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*PITTSBURGH, PA.
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South 2nd and McKean Street
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A. R. Young
518 North Delaware Street
ST. LOUIS, MO.
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Stocks carried.

OHIO GEARS

improving their products, and to determine the type of seamless tubing most suitable for specific purposes.

♦

Industrial Colloids Inc., 1316 West Cermak road, Chicago, has begun to manufacture its line of industrial colloids for various purposes, including high-temperature lubricants, high temperature joint compounds, plastic gaskets and packing compounds.

♦

Appointment of Allied Finishing Specialties Co., a division of Chicago Bronze & Color Works, 841 Larrabee street, Chicago, as licensors has been made by New Wrinkle Inc., Dayton, O. St. Louis Surfacer & Paint Co., 4200 Arlington avenue, St. Louis, has also been licensed by the company.

♦

Recently resigned as chief engineer of W. A. Jones Foundry & Machine Co., R. B. Moir has become associated with Foote Bros. Gear & Machine Corp., as director of sales research and engineering development.

♦

John P. Hoelzel, formerly vice president and general sales manager of Pittsburgh Screw & Bolt Corp., has been elected president. He has been connected with various sales positions in the company during the last 35 years.

♦

Since 1920 associated with sales of stainless and corrosion resistant alloy steels, Edward H. Platz Jr. has resigned from Faitoute Iron & Steel Co. to join the alloy steel sales department of Lebanon Steel Foundry, Lebanon, Pa.

♦

Edmond P. Severns, formerly general manager of sheet sales for Continental Steel Corp., Kokomo, Ind., has been elected vice president in charge of sales. Mr. Severns has been engaged in the steel industry for 17 years.

♦

George L. Abbott has been appointed director, vice president and general sales manager of Graton & Knight Co., Worcester, Mass., manufacturers of leather belting, leather packing, and other industrial leather parts.

♦

An addition to its aluminum research laboratories at New Kensington, Pa., is being built by Aluminum Co. of America, Pittsburgh.

♦

CORRECTION: In the October issue it was incorrectly stated that the Detroit Ball Bearing Co. of Ohio, Toledo, had become the successor to Ohio Ball Bearing Co. Actually, it is only the Toledo branch of Ohio Ball Bearing Co., Cleveland, that has been purchased by Detroit Ball Bearing Co. The Ohio Ball Bearing Co., which handles antifriction bearings and transmission equipment, has its head office in Cleveland and a number of branches throughout Ohio—at Akron, Cincinnati, Columbus, Dayton and Youngstown.

What do you look for most when choosing a speed reducer?
UNFAILING SERVICE . . .
LONG LIFE . . .
ALL AROUND ECONOMY
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Get all three by specifying Philadelphia Worm Gear Units
For years industry has recognized the superiority of Philadelphia Worm Gear Units for transmitting maximum input power with minimum loss and lowest operating and upkeep costs. They're built in both horizontal and vertical types . . . in a complete range of horsepowers and ratios to meet all requirements. Write now for catalog with full descriptions and engineering data.
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Bonded Rubber FLEXIBLE COUPLINGS

...for power transmission through *shear stressed* rubber, providing flexibility to absorb vibration and accomodate misalignment. A compact design without loose parts, easy to install, neat in appearance, of rugged construction. Sizes from ¼ to 1 hp. at 1750 R.P.M.

Write for Bulletin No. 200.

Lord Mfg. Co., Erie, Pa.

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BONDED RUBBER JOINTS

LORD BONDED RUBBER

SHEAR TYPE RUBBER MOUNTINGS

280 Madison Ave.
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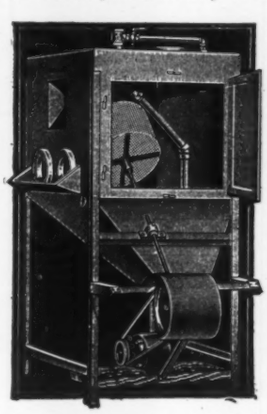
It takes rubber in shear to absorb vibration

A Real Labor Saver

LEIMAN BROS. PATENTED **Continuous Feed**

Sand Blast Outfit

For Manufacturers of Goods in Metal, Glass, Celluloid, Rubber, Wood and other materials



It furnishes a modern, cleanly way of cleaning moulding sand from patterns and castings. Letters and designs stencilled.

Will replace the scratch brush for mat finishing and similar effects on all classes of goods—it will replace the use of disagreeable acids for this work.

Finishes may be fine, medium or coarse on all materials as desired—but, most important, it will always be uniform—no streaky, uneven results.

Any article to be plated should be sand blasted first—it will result in a more permanent plate, a quicker plate, and a saving of time in plating and a saving of current.

The most inexperienced person can operate it without instructions—the work cannot be spoiled.

HARDENING SCALE REMOVED

makes machining quicker and better and Saves Cutting Tools—Gives better Color to Castings—Makers of Hardware, Tools, Gears, Machinery and Metal articles need the sand blast.

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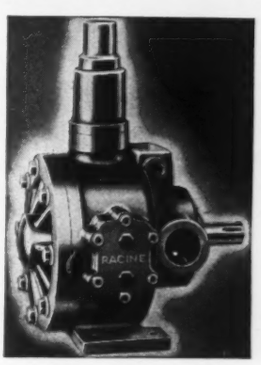

Extremely quiet, smooth performance. A thoroughly proven, efficient pump for pressures up to 1000 lbs. per sq. inch. Capacities 2000—4000—6000 cubic inches per minute.

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A complete line—manual—pilot or electrically operated. Balanced pistons—Accurately fitted. For oil-hydraulic installations.

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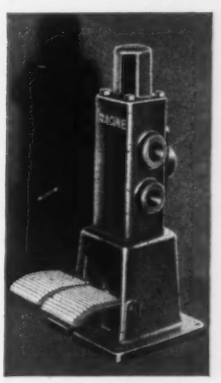
RACINE 4-Way valve—foot operated in both directions — Single treadle is furnished when valve is spring returned in one direction.



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NEW MACHINES—
And the Companies Behind Them

(For illustration of other outstanding machinery see Pages 52-53)

Air Conditioning

Self-contained heating systems, York Oil Burner Co. Inc., York, Pa.
Gravity furnace, Bryant Heater Co., Cleveland.

Bakery

Bread slicing machine, U. S. Slicing Machine Co., La Porte, Ind.

Dairy

Irradiators, Hanovia Chemical & Mfg. Co., Newark, N. J.

Die Casting

Die casting machine, Reed-Prentice Corp., Worcester, Mass.

Domestic

Toaster, McGraw Electric Co., Minneapolis, Minn.
All-electric kitchen, Dwyer Products Corp., Michigan City, Ind.
Automatic mixer, Chicago Flexible Shaft Co., Chicago.
Never-lift iron, Proctor Electric Co., Philadelphia.

Electrical

Electric power plants, Eicor Inc., Chicago.

Excavating

Quarry and mining excavator, Bucyrus-Erie Co., South Milwaukee, Wis.

Forging

Drop hammer, Erie Foundry Co., Erie, Pa.
Forging press, Florence Pipe Foundry & Machine Co., Florence, N. J.

Industrial

Oil reclaimer, The Hilliard Corp., Elmira, N. Y.
Fan unit, South Bend Air Products Inc., South Bend, Ind.

Materials Handling

Portable adjustable elevators, Mechanical Handling Systems Inc., Detroit.
Power scoop industrial truck, Elwell-Parker Electric Co., Cleveland.
Hydraulic die handling truck, Lyon Iron Works, Greene, N. Y.

Metalworking

Automatic milling machine, U. S. Tool Co. Inc., Ampere, N. J.
Ram type bending machine, Wallace Supplies Mfg. Co., Chicago.
Broaching machine, American Broach & Machine Co., Ann Arbor, Mich.
Automatic centering reel, F. J. Littell Machine Co., Chicago.
Precision tool grinder, Whitman & Barnes, Detroit.
Variable speed lathe, Schauer Machine Co., Cincinnati.
Gear finisher, Michigan Tool Co., Detroit.
Bench type drill press, Crescent Mfg. Co., Rockford, Ill.
Vertical turret lathe, The Bullard Co., Bridgeport, Conn.
Tool bit grinder, Oliver Instrument Co., Adrian, Mich.
Radial cam grinder, Landis Tool Co., Waynesboro, Pa.
Saw, Tannewitz Works, Grand Rapids, Mich.
Broaching machine, Colonial Broach Co., Detroit.
Radial type simplimatic, Gisholt Machine Co., Madison, Wis.
Surface grinder, The Blanchard Machine Co., Cambridge, Mass.
Broaching machines, The Oilgear Co., Milwaukee.
Lathe, The Bradford Machine Tool Co., Cincinnati.

Office

Adding machine, Victor Adding Machine Co., Chicago.
Automatic duplicator, Ditto Inc., Chicago.
Two-ribbon typewriter, L. C. Smith Corona Typewriters Inc., Syracuse, N. Y.
Portable adding machine, Swift Business Machines Corp., New York.
Office letter folding machine, Multistamp Co. Inc., Norfolk, Va.

Restaurant

Automatic electric bun steamer, Metal-Glass Products Co., Belding, Mich.
Steel-clad cooler, Tyler Fixture Corp., Niles, Mich.
Multispeed freezer, Taylor Freezer Corp., Beloit, Wis.
Electric and gas fryers, Anetsberger Bros., Chicago.
Unit air conditioner, General Refrigeration Corp., Beloit, Wis.
Device for cleaning seeds, Sharples Specialty Corp., Philadelphia.

Welding

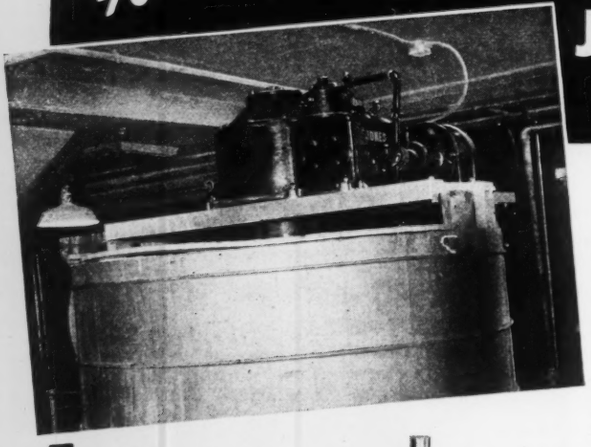
Oxy-acetylene cutting machine and generator, Linde Air Products Co., New York.
Electronic arc welder, Allis-Chalmers Mfg. Co., Milwaukee.
Arc welder, Lincoln Electric Co., Cleveland.
Arc welder, Commonwealth Mfg. Corp.

Woodworking

Floor sanding machine, Porter-Cable Machine Co., Syracuse, N. Y.
Brush-backed spindle sander, Vonnegut Moulder Corp., Indianapolis.

For driving agitators, mixers and similar equipment—

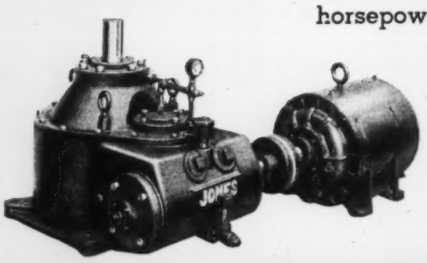
JONES WORM-HELICAL SPEED REDUCERS



HERE is a line of machines that fills a long felt need for double reduction units of the fully enclosed type to be used for agitators, mixers, etc. requiring a vertical shaft drive.

Many of these Jones units have established excellent performance records in a wide variety of service. As a result of that experience a complete standard line has been developed covering 15 standard ratios ranging from 40 to 1 to 250 to 1 for all common motor speeds and a wide range of horsepower ratings.

• This Jones Worm-Helical Speed Reducer on a lacquer agitator is typical of the wide range of services for which these drives can be used such as ore roasters, pulp tank mixers, furnaces, bending rolls and similar applications.



The new Jones Bulletin No. 75 covers complete details on these new Worm-Helical Speed Reducers, with rating tables, dimension diagrams, torque charts and other application information. We shall be pleased to send you a copy.

W. A. JONES FOUNDRY & MACHINE CO.
4413 Roosevelt Road, Chicago, Illinois

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CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

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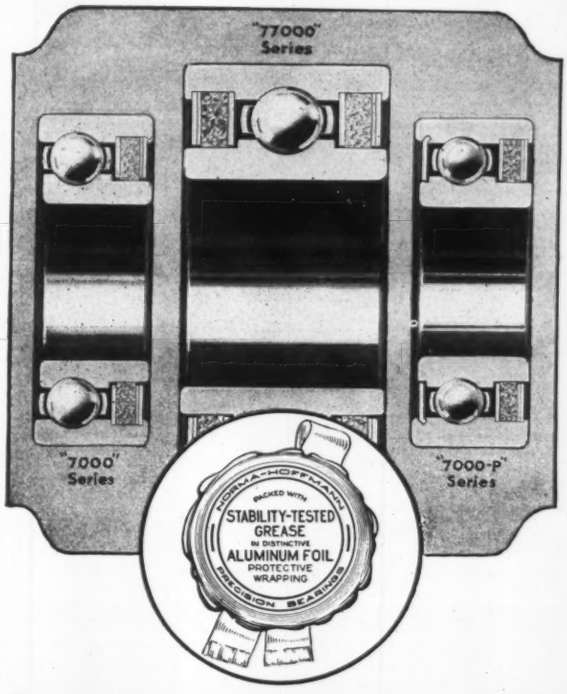

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Thick, closely-fitting felts between removable plates, forming an effective labyrinth against recessed inner ring.

FELT SEAL REMOVABLE in its entirety, for inspection, cleaning, or renewal of grease.

Wide inner and outer rings, with maximum contact on shaft and housing, make inserts in housing unnecessary and militate against slippage, looseness, and escape of lubricant past outer ring.

Felt seal entirely within confines of both rings; therefore not exposed to injury.

Seal construction avoids race distortion, assuring dimensional exactness and quiet running.

Grease capacity ample for long periods.

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PRECISION BEARINGS

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POSITIONS
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WANTED: Sales Engineer. Manufacturer of mechanical power transmission products doing national business has opening for man with successful sales record. Prefer age 30-37. Knowledge of machinery and transmission applications in various industries desirable. In answering give complete details of experience, education, nationality, appearance, also salary desired to start with. Assured permanent future. Answer kept confidential. Address Box 122, MACHINE DESIGN, Penton Building, Cleveland, Ohio.

POSITION WANTED: Registered engineer seeks position requiring complete knowledge of development, planning, cost reduction, machine and product design. Thoroughly experienced in machine tools, aeronautics, printing presses, carton machinery, transportation equipment and business machines. Address Box 123, MACHINE DESIGN, Penton Building, Cleveland, Ohio.

WANTED: One or two designing draftsmen capable of developing and supervising design and detail of medium weight automatic machines, preferably experienced in packaging machinery design. Full particulars of education, experience and salary desired, must be given to receive consideration. Address Box 124, MACHINE DESIGN, Penton Building, Cleveland, Ohio.

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Increase the utility and adaptability of your machines by equipping them with "S.O.S." Variable Speed Control. Inexpensive — yet adds tremendously to the value of machine tools, stokers, conveyors, traveling ovens, mixers, stirrers, etc.

"SELECT-O-SPEED" FEATURES

Infinite Speed Selection—finger tip control over a wide range. Ratios up to 10:1 available. **Uses Standard V-Belts. Sizes**—from fractional to 7½ H. P. Available with hand wheel, lever or electric control.

Our experienced Transmission Engineers will gladly help you design "Select-O-Speed" into your equipment.

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IDEAL COMMUTATOR DRESSER COMPANY

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INDEX TO ADVERTISERS

Abart Gear & Machine Co. 91
Accurate Spring Mfg. Co. ..... *
Ahlberg Bearing Co. ..... *
Air Reduction Sales Co. ..... *
Alemite ..... *
Allen-Bradley Co. ..... *
Allis-Chalmers Mfg. Co. ..... Inside Front Cover
American Brass Co., The ..... *
American Cable Div., American Chain & Cable Co., Inc. 26
American Chain & Cable Co., Inc. 81
American Engineering Co. ..... *
American Magnesium Corp. ..... *
American Metal Hose Branch of The American Brass Co. ..... *
American Screw Co. 95
American Steel & Wire Co. ..... *
Ampco Metal, Inc ..... *
Associated Spring Corp. ..... *
Auburn Button Works, Inc. ..... *

Baldwin-Duckworth Division of Chain Belt Co. 15
Bantam Bearings Corp. ..... *
Barco Manufacturing Co. 93
Bijur Lubricating Corp. ..... *
Bodine Electric Co. ..... *
Booth Felt Co. ..... *
Boston Gear Works, Inc. 79
Bound Brook Oil-Less Bearing Co. 3
Bower Roller Bearing Co. 88
Briggs & Stratton Corp. ..... *
Bristol Co., The ..... *
Brown & Sharpe Mfg. Co. ..... *
Bruning, Charles, Co., Inc. ..... *
Buckeye Brass and Manufacturing Co. ..... *
Bunting Brass & Bronze Co., The ..... *

Carnegie-Illinois Steel Corp. ..... *
Cerro De Pasco Copper Corp. ..... *
Chain Belt Company 90
Chandler Products Co. 4
Chicago Metal Hose Corp. 80
Chicago Molded Products Corp. ..... *
Cleveland Rawhide Mfg. Co. ..... *
Cleveland Worm & Gear Co., The ..... *
Clifford Mfg. Co. ..... *
Climax Molybdenum Co. ..... *
Columbia Steel Co. ..... *
Continental Screw Co. ..... *
Conway Clutch Co., The 67
Corbin Screw Corp. ..... *
Crocker-Wheeler Electric Mfg. Co. ..... Back Cover
Cuno Engineering Corp. 25
Cutler-Hammer, Inc. 85

Dayton Rubber Mfg. Co., The 29
De Laval Steam Turbine Co. 94
Delco Products, Division General Motors Corp. 73
Denison Engineering Co. 11
Diamond Chain & Mfg. Co. ..... *
Dow Chemical Co., The 30
Drop Forging Association 18
Dumore Co., The 12, 13
Du Pont, E. I. de Nemours & Co., Inc. 94
Durakool, Inc. ..... *

Eagle Pencil Co. ..... *
Elastic Stop Nut Corp. ..... *
Electro Metallurgical Co. 70
Farval Corp., The 20
Federal-Mogul Corp. ..... *
Foote Bros. Gear & Machine Corp. ..... *
Foote Gear Works, Inc. ..... *
Formica Insulation Co., The 68
Galland-Henning Mfg. Co. 92
Garlock Packing Co., The ..... *
Gear Specialties, Inc. 10, 21, 22, 23, 24
General Electric Co. ..... *
General Electric Vapor Lamp Co. 77
General Radio Co. ..... *
Greist Mfg. Co., The 66
Guardian Electric Co. ..... *

Hannifin Manufacturing Co. 82
Hilliard Corp., The 93
Holliston Mills, Inc., The ..... *
Howell Electric Motors Co. ..... *
Hunt, C. B., & Son 19
Hyatt Bearings Division, General Motors Sales Corp. ..... *
Hydro-Power Systems, Inc. 99

Ideal Commutator Dresser Co. ..... *
International Nickel Co., Inc., The ..... *

James, D. O., Mfg. Co. ..... *
Johnson Bronze Co. 101
Jones, W. A. Foundry & Machine Co. 98

Keuffel & Esser Co. 64, 65
Kingston-Conley Electric Co. 86
Koh-I-Noor Pencil Co., Inc. ..... *
Kropp Forge Co. 75

Laminated Shim Co., Inc. ..... *
Lamson & Sessions Co., The 97
Leiman Bros., Inc. ..... *
Lewellen Manufacturing Co. 102
Lincoln Electric Co. ..... *
Linde Air Products Co., The 69
Link-Belt Co. 97
Lord Mfg. Co. 91
Lovejoy Flexible Coupling Co. 76

McGill Mfg. Co. 9
Marlin-Rockwell Corp. ..... *
Master Electric Co., The ..... Inside Back Cover
Meehanite Metal Corp. ..... *
Michigan Tool Co. 61
Micro Switch Corp. ..... *
Milcor Steel Co. ..... *
Morganite Brush Co., Inc. ..... *
Morse Chain Co. ..... *

National Screw & Mfg. Co. 6
National Tube Co. ..... *
New Departure, Division General Motors Sales Corp. 99
New Jersey Zinc Co., The 95
Norma-Hoffmann Bearings Corp. ..... *

Ohio Gear Co., The 89
Oilgear Company, The 14
Orange Roller Bearing Co., Inc. 92

Parker-Kalon Corp. 96
Pease, C. F., Co., The 97
Peck Spring Co., The ..... *
Pheoll Mfg. Co. 95
Philadelphia Gear Works ..... *

Racine Tool & Machine Co. ..... *
Randall Graphite Products Corp. ..... *
Raymond Mfg. Co. ..... *
Reeves Pulley Co. ..... *
Reliance Electric & Engineering Co. ..... *
Richardson Co., The ..... *
Rivett Lathe & Grinder, Inc. ..... *
Rockford Drilling Machine Div. of Borg Warner Corp. 91
Roper, Geo. D., Corp. 93
Russell, Burdsall & Ward Bolt & Nut Co. ..... *
Ruthman Machinery Co. ..... *

Scovill Mfg. Co. 17
Shafer Bearing Corp. ..... *
Shakeproof Lock Washer Co. 88
SKF Industries, Inc. ..... *
Smith, Winfield H., Inc. ..... *
Speedway Mfg. Co. ..... *
Spring Washer Industry ..... *
Square D Co. 72, 84
Staedtler, J. S., Inc. 71
Standard Pressed Steel Co. ..... *
Steel Founders' Society of America ..... *
Stewart-Warner Corporation ..... *
Sundstrand Pump Division, Sundstrand Machine Tool Co. ..... *

Tennessee Coal, Iron & Railroad Co. ..... *
Thompson-Bremer & Co., The 63
Timken Roller Bearing Co., The 86
Tomkins-Johnson Co., The 74
Torrington Co., The ..... *
Trico Fuse Mfg. Co. ..... *
Tuthill Pump Co. ..... *
Twin Disc Clutch Co. ..... *

Union Carbide & Carbon Corp. 8
U. S. Electrical Motors, Inc. ..... *
United States Steel Corp. ..... *
United States Steel Products Co. ..... *

Veeder-Root, Inc. ..... *
Victor Electric Products, Inc. 83
Victor Manufacturing & Gasket Co. ..... *
Viking Pump Co. ..... *

Wagner Electric Corp. 16, 27
Waldron, John, Corp. ..... *
Western Felt Works ..... *
Westinghouse Electric & Mfg. Co. 90
Whitney Chain & Mfg. Co., The 95
Wickes Brothers ..... *
Wisconsin Motor Corp. ..... *

*Advertisements appear in previous issues

ECONOMY

JOHNSON *Ledaloyl*
SELF LUBRICATING

BEARING BRONZE

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● There are many factors that determine the real cost of a bearing. One is the unit price . . . another is the performance delivered. Regardless of how you figure costs, LEDALOYL is by far the most economical bearing available.

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As to performance . . . we ask that you test a LEDALOYL bearing in comparison to any sintered bronze on the market. Convince yourself that no other bearing will equal LEDALOYL'S record for long life, quiet operation and smooth performance. Your inquiry carries no obligation.

The most complete SLEEVE BEARING SERVICE in the world

JOHNSON BRONZE COMPANY
Sleeve BEARING HEADQUARTERS
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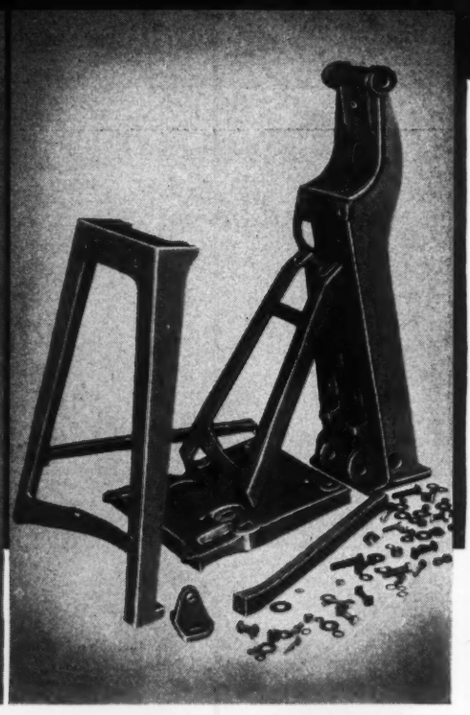
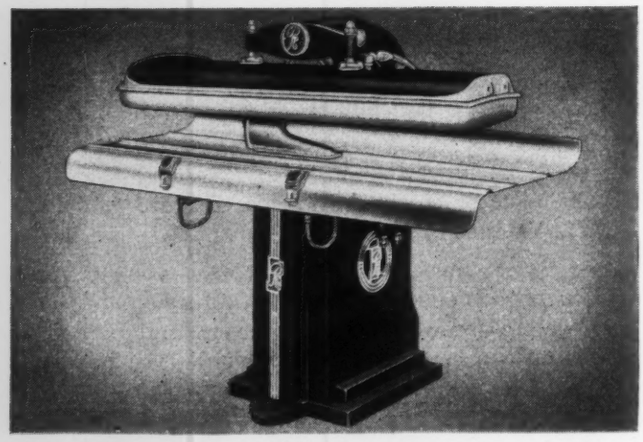
★ GIVE YOUR CUSTOMERS WELDED STEEL ★

USER BENEFIT OF WELDED STEEL—Savings in floor space. Welded frame 8 inches smaller, 300 lbs. lighter.



OLD DESIGN—Bulky 7-piece frame bolted together. Wasted space and power by scattered arrangement and poor rigidity.

● Here are two of many machinery-user benefits credited to welded design by The Prosperity Co., manufacturers of garment-pressing machinery, Syracuse, N. Y.



USER BENEFIT OF WELDED STEEL:—Faster machine operation because of greater rigidity of stress members.

USER BENEFIT NO. 1—16% Saving in Floor Space. Single-unit welded frame replaces bulky 7-piece structure bolted together with 76 bolts, washers and nuts. Welded frame actually 8 inches smaller and 300 pounds lighter than previous design.

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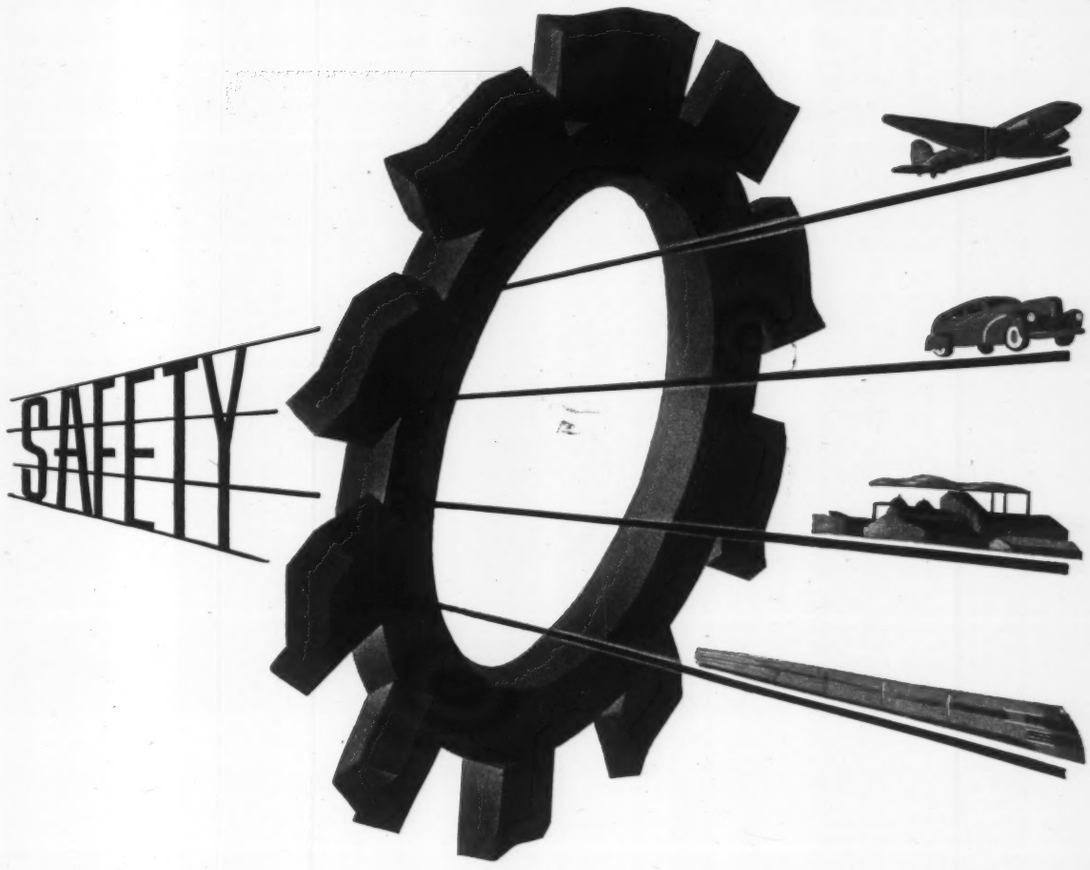

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